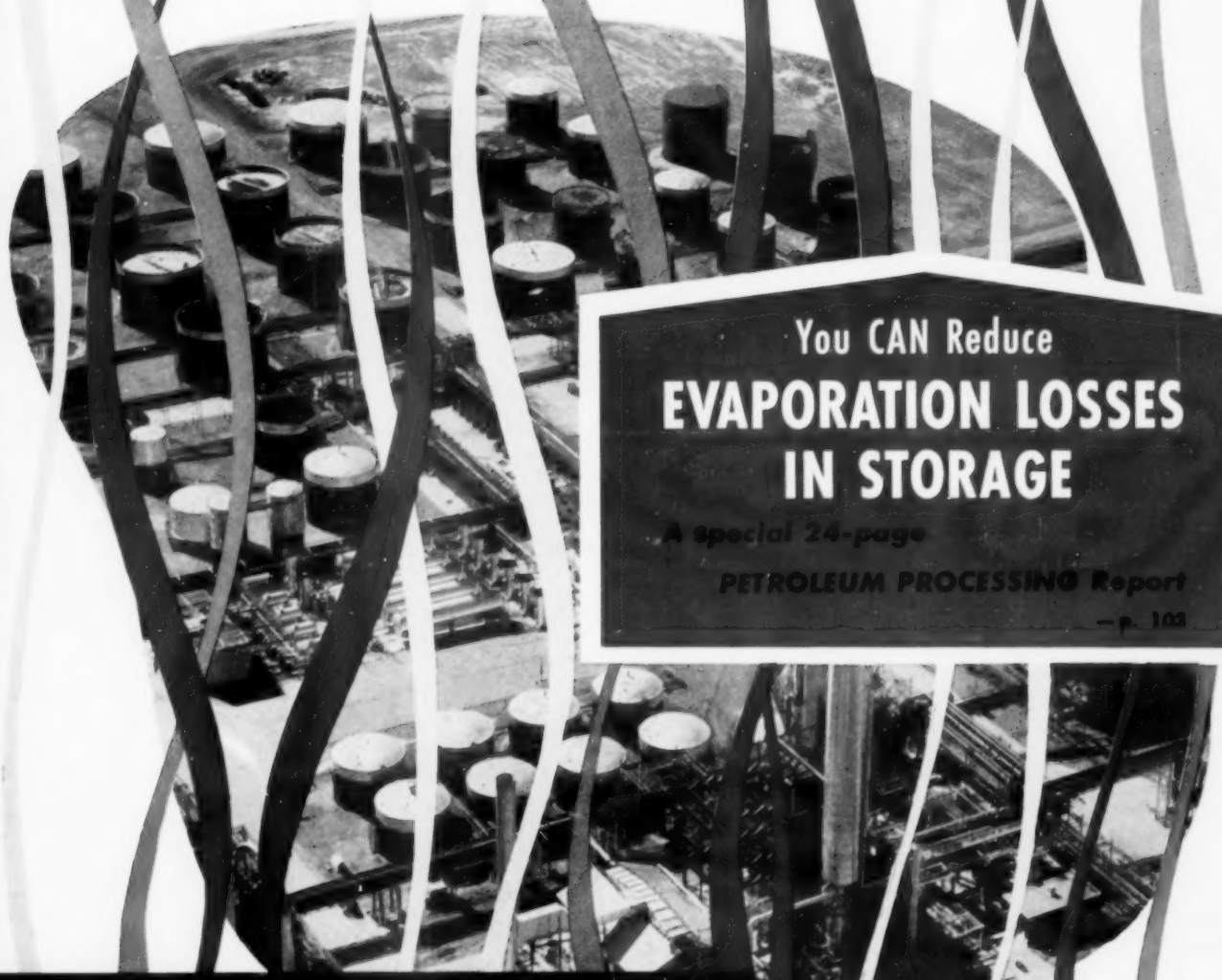
Petroleum Processing

Petroleum Refining • Petrochemical Manufacturing • Gas Liquids Recovery JULY, 1956



You CAN Reduce

EVAPORATION LOSSES IN STORAGE

A special 24-page PETROLEUM PROCESSING Report —p. 103

Also in this Issue:

Forecasts Are Up — The Mid-Year Outlook ..... p. 69
How to Save Time in the Drafting Room ..... p. 78
Two Routes to Better Job Performance Today ... p. 90

A McGRAW-HILL PUBLICATION PRICE 35 CENTS

PETROLEOS MEXICANOS

Gas Processing Plant

REYNOSA, MEXICO

Below the Rio Grande, near Reynosa, in Tamaulipas, Mexico, Petroleos Mexicanos has recently completed this major gas processing project designed to process 300 million cubic feet of natural gas daily gathered from numerous fields within an area of about 400 square miles. About 8,000 barrels per day of fractionated products, including propane, butanes, motor fuel, naphtha and kerosene will be produced.

Engineering design and procurement of equipment was entrusted to Hudson, and the satisfaction of our client is attested by a current contract for a similar but even larger project for Petroleos Mexicanos on the Isthmus of Tehuantepec.

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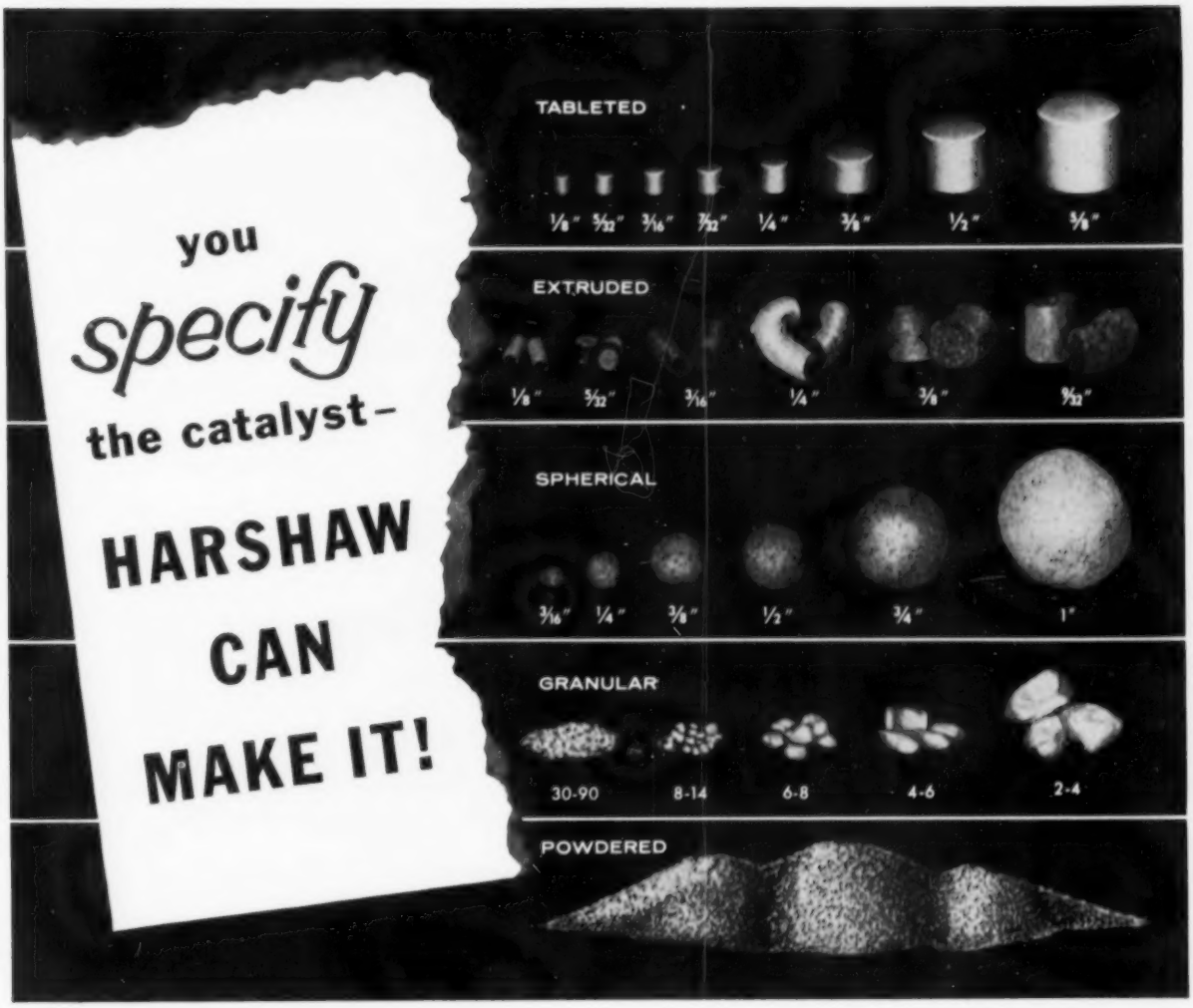

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Reader's Guide What's New in Petroleum

I II III 1 2 3 4 5

An Extra This Month

Stop those

EVAPORATION LOSSES

It Can Mean "Money in the Bank"

A special 24-page PETROLEUM PROCESSING Report

Today, an estimated 3% of all petroleum produced in this country is lost by evaporation on its way from well to consumer.

This loss amounts to about 75-million bbl., or $300-million each year.

What can be done about it? The refiner – with storage tanks at both ends and in the middle of his plant – has a big stake in this loss by evaporation during storage. And with helpful information, he can do a lot to solve the problem.

This special report, prepared by Willis A. Bussard of the PETROLEUM PROCESSING editorial staff, is aimed at three major targets:

1 – What is evaporation and what causes it?
2 – What types of evaporation losses confront today's petroleum processor?
3 – What equipment and techniques can the refiner use to reduce the loss?

turn to p. 103

I III 2 3 4 5

I II III 1 2 3 4 5

Forecasts Revised Upward

What today's outlook shows you for the rest of this year. Your annual mid-year look at refining operations indicates that all January, 1956, supply-demand forecasts were conservative. By V. B. Guthrie. **p. 69**

I 3 5

THIS MONTH'S M&C FEATURE

Decisions Cost Money

Why not pre-plan your next maintenance and construction job? The high overhead cost of top management being involved in a decision for every problem can be slashed by planning emergency action ahead of time. By F. O. Pierson. **p. 71**

. . . and starting this month

Your M&C Problem Corner

The 12 members of your M&C Panel begin to answer your specific questions on maintenance and construction. Subjects this issue include:

- Oil in instrument air
- Packing for hydrogen (ammonia) compressors

I II III 3 4

How to Boost Drafting Speed

First of a four-part series on a much neglected subject–drawing room procedures. Robert Kern tells you how you can speed up plant construction or revamping jobs by the use of modern, efficient drafting room procedures and equipment. **p. 78**

I II III 2

A McGRAW-HILL PUBLICATION

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Processing for July, 1956

Technical Tips on Octanes

The newest information available for you as a process man, from today's plant operators. The third in our 1956 series of articles based on the popular question-and-answer session at the Western Petroleum Refiners' Assn. fall meeting.. **p. 83**

I III 2 3 5

Rendezvous in Montreal

Meet your friends and acquaintances again. Two pages of photographs made by the PETROLEUM PROCESSING staff cameraman during the annual Mid-Year meeting of the American Petroleum Institute Division of Refining in Montreal. **p. 88**

I 1 2 3 4 5

Two Routes to Better Performance

In days to come, job rotation and job enlargement will surely play a larger role in personnel development. Author Joe Fuller tells how oil companies are using these techniques today to help the technical man grow in his job. **p. 90**

I II III 1 2 3 4 5

Ready for Oil Progress Week?

Of course, this event doesn't take place until next October. But, you'll find it pays to start your planning for it today. Here's a round-up by staffer Stu Boynton on what some refiners are doing right now for 1956 Oil Progress Week. **p. 93**

I 3 5

500 Pipe Spools a Week

. . . and for virtually one solid year. That's the production record set in this special fabrication shop at Tide Water Oil's now-a-building refinery at Delaware City, Del. For the first time, here is the story on how it was done. **p. 96**

I 2 4

What's the Latest Word?

Are you keeping yourself up-to-the-minute on the newest information about equipment, materials, and services? Every month? We recommend you check regularly on the latest word as reported in our monthly What's New! department. **p. 181**

I II III 1 2 3 4 5

and What's Ahead

More Information-Packed Issues

Keep your eyes peeled for the postman with your copy of PETROLEUM PROCESSING every month.

You will be finding articles on these subjects in upcoming issues—some soon, others later:

- A brand new editorial department we're convinced you will like
- More on faster drawing techniques
- A special economic appraisal of sulfur in gasoline
- New ideas for reducing operating costs
- Your annual survey of petrochemicals

DEPARTMENTS

Advertisers' Index 178	Patents 159
Book Reviews 171	Personals 153
Editorials 212	Plant Practices 143
Engineering Data Sheet. 151	Process Data Sheet 139
Equipment—	Publisher's Page 7
What's New! 181	Readers' Service Card .. 179
Information Offered ... 176	Statistics 173
Letters 19	Suppliers News 167
Meetings for Oil Men... 157	Tomorrow 15
New Words 149	What's Happening 9
Operating Trends 173	What's New! 181

Continue "Readers' Guide" on p. 135

HOW TO USE IT:

Your new "Reader's Guide to What's New in PETROLEUM PROCESSING" will do two things for you. First, the key numbers with each article will tell you at a glance if it is within your scope of interest; Roman Numerals indicate industries; Arabic Numerals, fields of activity. Second, the longer descriptions will tell you what each article is about, and why it can be of help and interest to you. —THE EDITORS

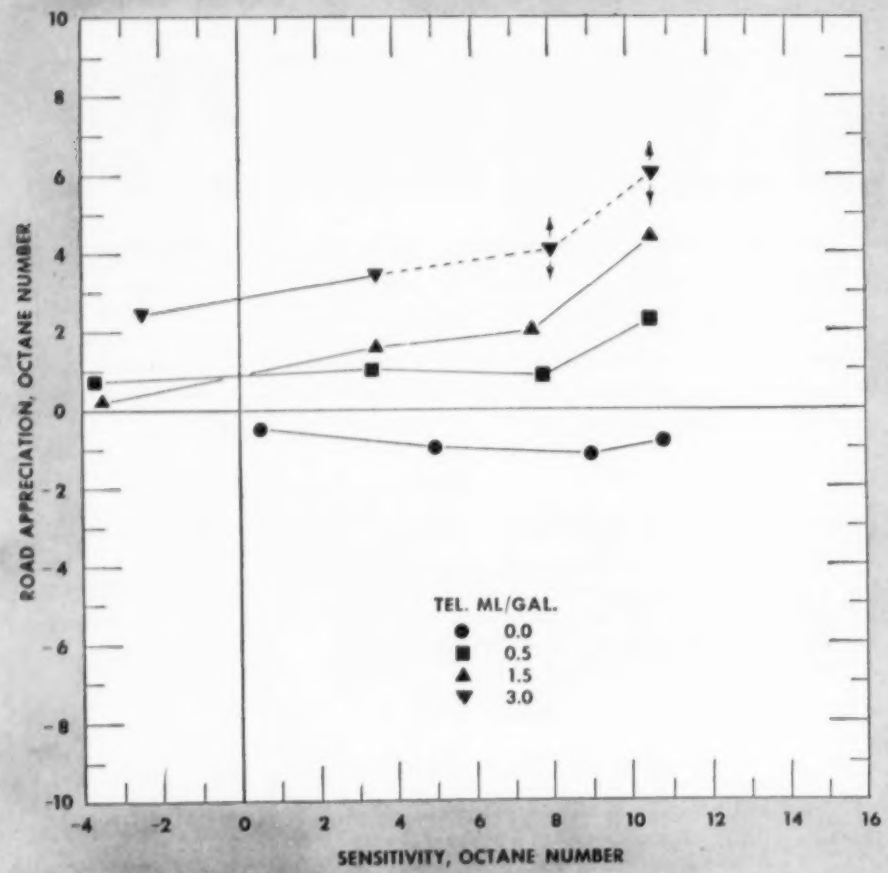

Fig. 1. Sensitivity versus appreciation. Note that the appreciation at any given sensitivity level increases with lead concentration.

Blending Hydrocarbons for Maximum Octane Potentials

By F. D. BUERSTETTA
Ethyl Corporation, Detroit, Mich.

The manufacture of high-octane gasolines to meet today's and tomorrow's automotive demands is putting increasing pressure on the refiner. To meet these requirements, the available hydrocarbon components in the refinery must be blended to best advantage to give maximum performance on the road.

Each octane number at the 100-octane level may cost as much as 15 to 20 cents per barrel. Thus there is a marked incentive for insuring that every laboratory octane number, obtained at this great expense, provides corresponding antiknock performance in cars on the road.

Hydrocarbon blends studied

As part of a continuing Ethyl Research program to establish the fundamentals of laboratory versus road antiknock quality, a study was recently conducted in which the behavior of blends of pure C_7 and C_8 hydrocarbons was examined.

Within this C_7-C_8 range, the four basic hydrocarbon types—olefins, paraffins, naphthenes and aromatics—were blended in varying proportions. Actually, a mixture of isooctane and *n*-heptane was used as the paraffin constituent to permit maintenance of a constant Research octane number while investigating the effects of tetraethyllead concentration and variations in hydrocarbon-type composition. Toluene, diisobutylene and methylcyclohexane were selected to represent the aromatics, olefins and naphthenes, respectively. Each of these hydrocar-

(To obtain more data on advertised products see page 178)

Send for your free copy of a technical paper entitled "Octane Possibilities with C_7-C_8 Hydrocarbons" by F. D. Buerstetta and T. W. Warren. Address your request to Box 23, Ethyl Corporation, 100 Park Avenue, New York, N.Y.

bons was blended in concentrations of 20, 40 and 60 per cent by volume with the proper paraffin mixture, giving nominal Research octane levels of 92, 96 and 100 at each of four tetraethyllead concentrations—0.0, 0.5, 1.5 and 3.0 ml. per gallon.

Each blend was evaluated in single-cylinder laboratory test engines and was then rated in the 9 to 1 compression-ratio engine of a 1955 passenger car equipped with an automatic transmission. Road ratings were made by both the Modified Uniontown and Modified Borderline techniques.

Road appreciation defined

Some of the test results are summarized in Table 1 in terms of road appreciation, which is the road antiknock rating of a fuel minus its Research octane number—or the bonus obtained in actual engine performance over the indicated laboratory knock rating.

The general analysis of data shown in Table 1 may permit a refiner to achieve better road performance than could be secured by using only Research octane number as a guide. It will be seen that aromatics should be maximized and olefins minimized as much as possible when making top-octane fuels. Since most of today's catalytic reforming processes eliminate naphthenes through dehydrogenation to aromatics, consideration of them is somewhat academic, but nonetheless interesting.

Further evaluation of the large quantity of test data obtained from this project indicates a most interesting correlation between appreciation and the concentration of tetraethyllead. Figure 1 shows a plot of sensitivity versus appreciation with points representing the same tetraethyllead concentrations connected. It can be seen from Figure 1 that the appreciation at any given sensitivity level increases with lead concentration.

Conclusions

The general conclusions which can be obtained from the study are as follows:

1. Best over-all antiknock performance can be obtained by blending a high proportion of aromatics with paraffins and adding the maximum amount of tetraethyllead.

2. Where low-speed knock resistance is critical, high aromatic content is necessary.

3. Where high-speed antiknock performance is critical, high aromatic content is less important, but maximum tetraethyllead concentration is still essential.

Table 1. Average change in road antiknock appreciation with addition of aromatics, olefins or naphthenes to paraffins in the C_7-C_8 range.

Research Octane No.	Added Component	Modified Uniontown	Modified Borderline	
			Low Speed	High Speed
92	Aromatics	+0.6	+1.1	+0.6
	Olefins	+0.3	+1.1	−2.0
	Naphthenes	+0.6	+2.0	+3.8
96	Aromatics	+0.9	+1.7	+0.6
	Olefins	+1.6	+1.1	−3.3
	Naphthenes	+2.4	+4.2	+2.7
100	Aromatics	+0.8	+1.5	−0.7
	Olefins	+0.5	+0.0	−5.7
	Naphthenes	+3.4	+3.7	+1.7

HOW Ethyl Research can help you

At today's high octane levels, the science of blending hydrocarbons has taken on more and more importance. As a service to the oil industry, Ethyl Research has launched a hydrocarbon blending program of its own to complement the intensive effort which the industry is devoting to this problem.

We are now testing many new blends in our laboratories and in high-compression engines on the road. Much of the data from these tests is being interpreted in terms of "road appreciation" to give refiners a better idea of the effectiveness of each blend. Write for a copy of "Octane Possibilities with C_7-C_8 Hydrocarbons"—another in the continuing series of reports from the Ethyl Corporation on fuel blending and other studies of vital interest to refiners today.

For further information, just call your Ethyl Representative. He'll be happy to arrange an appointment for you with one of our Technical Representatives.

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Nalform

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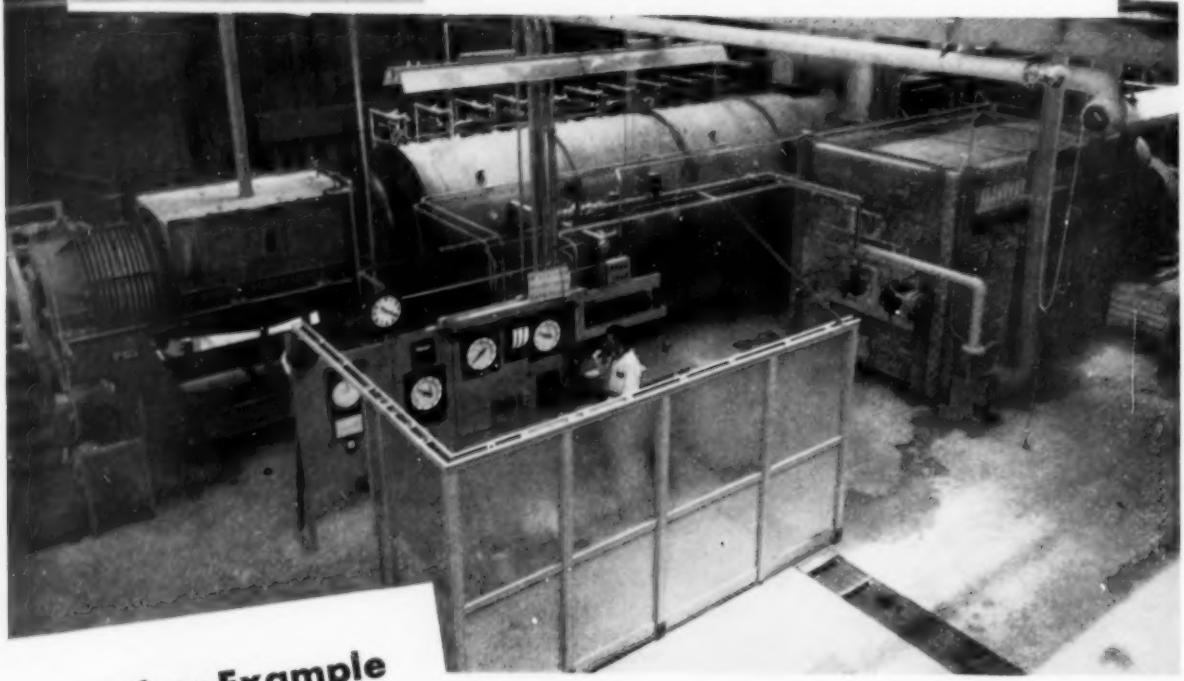

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● Fluid hydroforming to upgrade petroleum products is one of the typically rapid advances in the Petroleum Industry that the Nalco Catalyst Division is proud to have had a part in making possible.

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Publisher's Page

The Story Behind This Month's Extra

YOU will find another one of our Special Reports on pp. 103-124 in this issue, the third since we began publishing them last August. The subject this time is "Evaporation Losses and Their Control in Storage."

I'm not going to tell you how serious evaporation losses are—nor how important it is that our industry do everything practical to reduce them. You'll find that in the report itself. But I do think you'll be interested in learning a bit of the background of such reports, how they are pulled together, and what it takes to produce them.

The subject of this month's report was settled on over a year ago, when we were planning our 1956 publishing program. At that time we also decided it would have to be staff-written, because it would require talking to so many different manufacturers and users.

Willis A. (Buzz) Bussard, one of our assistant editors, and a mechanical engineer (Cal Tech '44), drew the assignment back in December. He was asked to study everything possible on evaporation. After weeks of digging and checking, he began to shape up his ideas of how the report should be handled—and he put together his first rough outline. It was four outlines later, however, before he'd made one that satisfied both him and us.

While Buzz was developing these outlines, he was thinking not only of the topics to be covered and the information to be included. He was thinking also of how each subject could best be related to the other, what headlines could introduce each subject, and how each part would be illustrated and laid out in the final report, page by page. In fact, his final outline was essentially in the form of the headlines you will read in the report, each fitting into the pattern of the text and the illustrations.

Once the final outline was finished, Buzz had already found a lot of the data he needed, and was ready to start writing. All in all, he figures he travelled some 2000 miles to see equipment in operation and talk with people in the field. He visited, or corresponded in detail, with some 55 persons to get the information he wanted—and spent about 160 hours doing it. Buzz estimates it took him another 120 hours to handle the writing and editing, and to work with our art director, Bill Caperell, and our illustration department on the layout.

For only a 24-page report, this sounds like a lot of time and effort. But, we are convinced that the result will be a continual source of helpful information for you—information available no other place in such a neat, compact, organized package.

William F. Bland

—Editor

Other McGraw-Hill Petroleum Publications

National Petroleum News
The monthly magazine of oil marketing—news, prices, transportation, storage, merchandising

Platt's Oilgram News Service
A daily independent oil-news reporting service issued from New York, Chicago, Houston

Platt's Oilgram Price Service
A daily independent oil-price reporting service issued from New York, Chicago, Houston

Petroleum Week
The industry-wide magazine—covering production, processing, transportation, marketing

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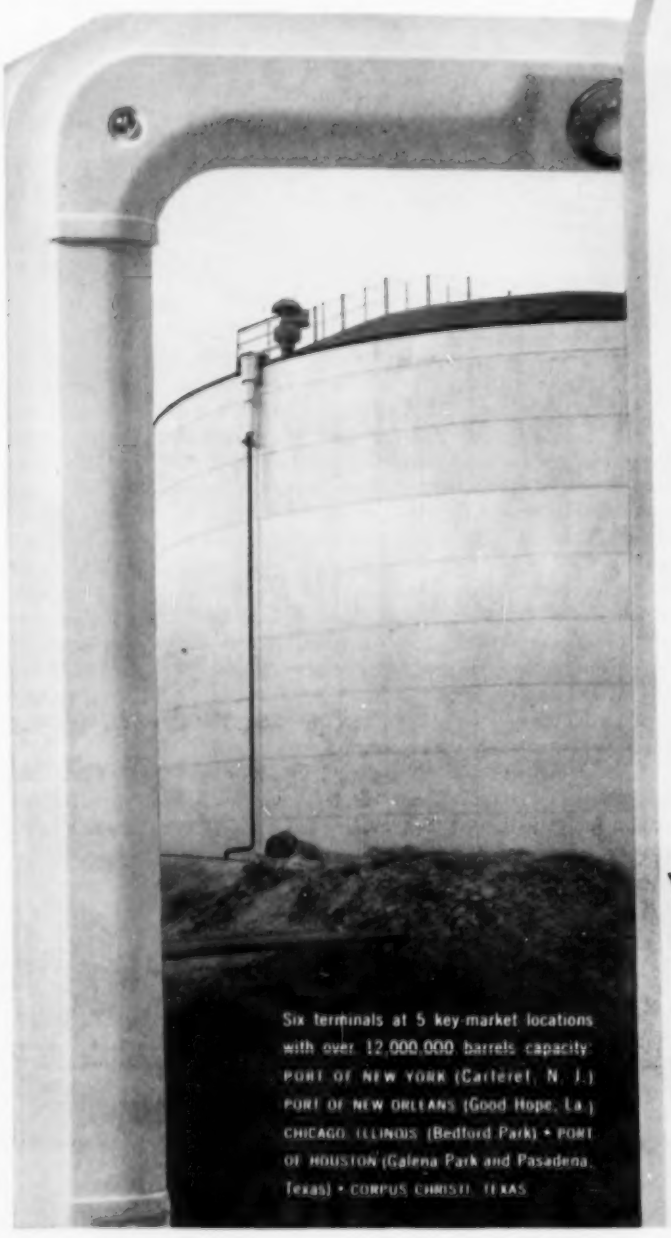

Six terminals at 5 key-market locations with over 12,000,000 barrels capacity: PORT OF NEW YORK (Carteret, N. J.) PORT OF NEW ORLEANS (Good Hope, La.) CHICAGO, ILLINOIS (Bedford Park) • PORT OF HOUSTON (Galena Park and Pasadena, Texas) • CORPUS CHRISTI, TEXAS

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What's Happening

in Refining

. . . **As nation-wide octanes hit new highs** in May, according to Ethyl Corp.'s monthly survey—96.7 for premium and 89.7 for regular—and Esso Standard introduced a new 100-plus octane grade to trade, refiners were off on new building sprees to keep pace with octanes . . .

Gulf Oil Corp. will build a second UOP Platformer of 26,000 b/d at Philadelphia, a twin to one previously announced.

Texas City Refining Co. plans a catalytic reformer for early 1957, size and type undecided.

Delhi-Taylor Corp. will add a 10,500 b/d UOP Unifiner-Platformer at Corpus Christi with completion scheduled early 1957.

Anderson-Prichard Oil Corp. will have Procon, Inc. build a 5000 b/d UOP fluid catalytic cracker at Cyril, Okla. Completion is due early 1957.

Esso Standard Oil Co. will add 7200 b/sd Powerformer at Everett, Mass., to be built by Badger Manufacturing Co., scheduled for mid-1957 operation.

Southland Co. will expand its recently acquired Delta Refining Co. refinery at Memphis to 10,000-11,000 b/d from its present 6000 b/d capacity and will install a 3100 b/d catalytic cracker and alkylation plant.

. . . **Refining capacity is on upswing too,** playing a part in tougher market competition.

Standard Oil Co. of Ohio will more than triple present 25,000 b/d capacity of Toledo, Ohio refinery, spending $35 to $45-million. M. W. Kellogg has started plans, with expansion set for December 1957 completion.

Premier Oil Refining Co. is expected to announce expansion plans soon. Company has refineries at Baird, Ft. Worth and Longview, Texas.

Two other Texas refiners plan refining additions: **Onyx Refining Co.** with 6500 b/d refinery at Abilene and **McMurray Refining Co.** with 22,500 b/d refinery at Tyler.

British American Oil Co., Ltd. will add 21,500 b/d to present 40,000 b/d capacity at Clarkson, Toronto refinery. Canadian Kellogg Co., Ltd. will handle the $5.5-million expansion project.

. . . **Richfield Oil Corp.** and **Union Oil Co. of Calif.** are both reported considering refinery sites on the Tulalip Indian Reservation on Port Gardner Bay in northwest Washington. Recent Congressional action allows the Indians to sell this land without consent of the Secretary of the Interior.

. . . **Sioux Oil Co.** will add propane and butane recovery at its two Newcastle, Wyo. refineries.

. . . **World's first Aspeco Process shale oil plant** will be built by Stearns-Roger Manufacturing Co. for Denver Research Institute. The one t/hr pilot plant is scheduled for operation next fall.

. . . **Sun Oil Co.** has options on 500 acres in New Jersey for possible expansion. Tract is across the Delaware River from Sun's Marcus Hook, Pa. refinery.

. . . **The Pure Oil Co.** has announced a new isomerization process called Isomerate. Its purpose is to upgrade 200°F end point light straight-run and natural gasoline for increased production of premium motor fuels. This is the third new isomerization process, the others: Atlantic Refining Co.'s Pentafining and Universal Oil Products' Penex.

. . . **Other new construction projects,** indicated by recent fast tax write-off approvals, were:

- Continental Oil Co., $525,000 for 1500 b/d catalytic reforming unit, Artesia, N. M.
- Sun Oil Co., $500,000 for 30,000 b/d pretreater for catalytic reformer, Marcus Hook, Pa.
- Houdry Process Corp., $201,000 for 6000 lb/day petroleum refining catalysts, Paulsboro, N. J.

in Gas Liquids Recovery

. . . **Cities Service Oil Co. (Del.)** will be the operator of a new natural gasoline plant to be built in Midland County, Texas. The new plant is jointly owned by lease holders operating in the vicinity. Delta Engineering Co. of Houston will build the plant with an initial capacity of 25-million cu ft/day and an ultimate capacity of 50-million. Operation is scheduled early 1957.

in Petrochemicals

. . . **Polyethylene again steals the limelight** in petrochemical plans.

Phillips Petroleum Co. now has licensed its new low-pressure process to four U. S. and six overseas firms, the latest being to Badische Anilin und Soda Fabrik (BASF) for exclusive German rights.

Standard Oil Co. of Indiana has culminated several years of research on high-density polyolefins by a non-exclusive license to **Eastman Kodak Co.** to use Standard's new process for polyethylene and polypropylene plastics at the Longview, Texas plant of Texas Eastman Co.

Union Carbide and Carbon Corp. will build low-pressure polyethylene plants at Institute, W. Va. and Seadrift, Texas, using combination of the Ziegler and Phillips processes along with technical improvements developed by Union Carbide. Completion is scheduled early or middle 1957.

. . . **Ethyl Corp.** has announced plans for expansion and diversification. A new plant at Baton Rouge, La. will produce vinyl chloride from ethylene in late 1957. Cost of the project being built by Catalytic Construction Co. is "several million dollars." In addition, Ethyl

has several options on land around Joliet, Ill. for a possible new TEL plant.

. . . **Allied Chemical & Dye Corp.** will build sulfuric acid plant next to Esso Standard Oil Co.'s Bayway, N. J. refinery. Esso will supply raw materials to Allied, with finished products returning to Esso.

. . . **Lake Charles Chemical Corp.** will have Fluor Corp., Ltd. build a $6.25-million b/d delayed coker and calcining unit at the affiliated Continental Oil Co.'s Lake Charles, La. refinery. Completion due in a year, with about $5.9-million of the project on fast tax write-off approval.

. . . **Canadian Oil Companies, Ltd.** will be first in Canada to extract chemically pure benzene, toluene and xylene from petroleum by installing a 3650 b/d Udex unit and a second Platformer (4400 b/d) at its Sarnia, Ont. refinery.

. . . **B. F. Goodrich Chemical Co.** will up production of "Geon" polyvinyl resins and plastic compounds at Avon Lake, Ohio plant with $8-million expansion set for completion early 1957.

. . . **Jefferson Chemical Co.** is considering plans to expand and diversify its Port Neches, Tex. plant.

. . . **Firestone Tire & Rubber Co.** will add a 75,000 t/yr styrene plant next to its butadiene plant now going up at Orange, Tex. with 1957 completion.

. . . **Gulf Oil Corp.** is considering a third ethylene unit at its Port Arthur, Tex. refinery.

. . . **Phillips Chemical Co.** will build a 60 t/day sulfur plant in Andrews City, Tex., next to a natural gasoline plant now being built.

. . . **Humble Oil & Refining Co.** will start July to expand Baytown, Tex. butadiene capacity to 65,000 t/yr with completion due next year.

. . . **Odessa Butadiene Co.,** near Odessa, Tex., plans 50,000 t/yr butadiene plant with Houdry butane dehydrogenation process and Esso Research cuprous ammonium acetate purification process. Fluor Corp., Ltd. will design, engineer and build with completion due mid-1957.

. . . **B. A. Shawiningan, Ltd.** will expand its Montreal East phenol production by 50%.

in Transition

. . . **Grace-Cosden** merger is off. W. R. Grace Co. cancelled agreement saying that Cosden Petroleum Corp.'s proven crude oil reserves were below the minimum in the agreement. Cosden board members were unwilling to consider lower price.

. . . **The Texas Co.** bid to buy British-owned Trinidad Oil Co. has been "approved in principle" by the British government contingent upon certain conditions in marketing, production, refining, exploration and employes. More heated debates are expected in the British Parliament. Texas Co. spokesmen have declined to comment at present.

. . . **Sunset Oil Co.** stockholders have approved a plan to merge with the International Mining Corp. The latter's stockholders will vote on this proposal next month.

. . . **American Petrofina and Panhandle Oil** directors have agreed to merge. The surviving company would be American Petrofina. Stockholders will vote on the proposal at a later date.

. . . **Union Carbide and Carbon Corp.'s** contract for purchase of government's 60,000 t/yr Louisville, Ky. butadiene plant has been torn up by House's Armed Service Committee. Plant will be offered for sale again without restriction that it be maintained for butadiene production.

. . . **Dow Chemical Co.'s Midland Div.** has an option to buy Bay Refining Corp. and its associate, Bay Pipe Line Corp. Meanwhile, Dow plans a petrochemical plant next to Bay refinery at Bay City, Mich., to use refinery by-products to make ethylene. Completion is expected at end of 1957.

. . . **Lion Oil Co.'s** 14-week strike is over, and full production resumed at its El Dorado, Ark. refinery. Terms of the new Union contract were not disclosed.

in Foreign Operations

. . . **Britain and Europe:**

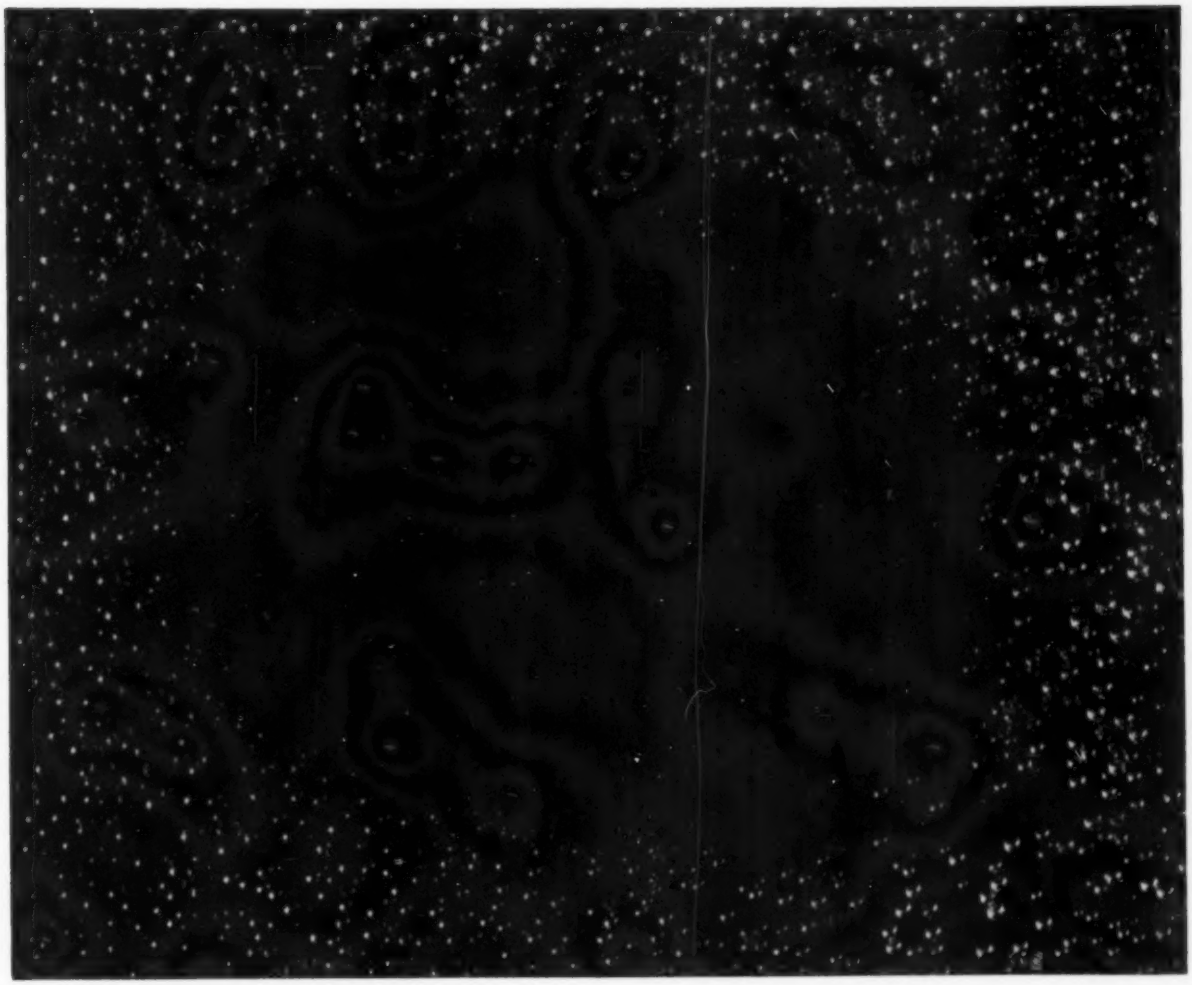
Shell and **British Petroleum** will give British motorists a 100 octane "super" gasoline as a third grade. Due in the near future, this compares to previous premium octane of about 86.

Regent Oil Co., owned jointly by Caltex and Trinidal Oil Co., according to most recent information (see What's Happening, June, 1956, pg. 12), plans a $51-million expenditure on its 40,000 b/d refinery near Southampton, England, with expected future expansion to 60,000 b/d.

French refining capacity rose 66,000 b/d during 1955 to reach a total of 604,700 b/d.

Petrochemicals Limited (Royal Dutch/Shell) is adding 25,000 t/yr ethylene oxide plant to its Partington plant, near Manchester. Completion is due mid-1958. Process is Shell Development Co.'s direct catalytic oxidation of ethylene.

A new French chemical industry is rising in southwestern France as a result of last year's natural gas discovery at Lacq. Pechiney, l'Office National Industriel de l'Azote, Saint-Gobain and Pierrefitte-Kalaa-



An Inside-Out View

CORROSION INHIBITOR AT WORK

Here's an external view of what takes place internally in refinery equipment. This photograph shows a piece of mild steel. The center has been treated with Polyrad. The entire piece of steel then was immersed in an acidic environment. The tiny bubbles of hydrogen show the beginning of corrosion. But the center portion remains a safety island—thanks to Polyrad.

This photographic impression bears out what most refinery operators already know—that Polyrad is an effective inhibitor. It will economically reduce corrosive damage with an average treatment of about 1 quart of Polyrad per 1,000 barrels of fluid.

Polyrad's powerful detergent action also serves to loosen organic and inorganic deposits, allowing them to be removed in the fluid stream.

All around the refinery, Polyrad can help maintain throughput, increase heat transfer, reduce metal loss, and cut down-time for maintenance. A Hercules technical representative will be glad to explain how Polyrad can be used to combat your specific corrosion problem.

Pine Chemicals Division, Naval Stores Department
HERCULES POWDER COMPANY
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FILMING AMINE INHIBITOR

Djerda have agreed to build plants using the gas. Initial production will be sulfur.

Societé Industrielle Belge Des Petroles will raise capacity of Antwerp, Belgium refinery to 100,000-120,000 b/d next year following an expansion from 58,000 b/d up to 75,000 b/d this year.

Naphthachimie plant near Marseilles, France will up ethylene capacity to 18,000 t/yr and double propylene to 18,000 t/yr.

Farbwerke Hoechst in West Germany is testing a new process for making olefins from crude or residual fuel. The oil is preheated, then sprayed onto coke that is heated to over 700°C. About 40% of the oil is claimed to crack to C_2-C_4 olefins, with most of the rest of the cracked products being methane and hydrogen.

British Petroleum Co. will spend $73-million to up Kent, England refinery to 140,000 b/d. Added will be 80,000 b/d distillation, 10,000 b/d catalytic reforming, 8000 b/d Hydrofining, 2600 b/d alkylation and thermal reforming—all scheduled for 1958 onstream dates.

. . . Latin America:

Empresa Colombiana de Petrólcos plans 1957 completion of a $4-million modernization of five natural gasoline plants in De Mares field. Ralph M. Parsons Co. will make an engineering study.

Two separate U. S. groups will invest a total of $66-million in two refinery projects in Panama. Slated for building in next 2½ years are identical 55,000 b/d refineries and petrochemical plants, $22-million for each refinery and $11-million for each petrochemical facility, the latter for anhydrous ammonia and urea. One firm, **Panama Refining & Petrochemical Co.,** may award Foster Wheeler the contract, and will locate near Colón, on Atlantic Coast. The other firm, **Panama Refining Co.,** has not yet disclosed its plans.

The Venezuelan government plans to build a refinery of "small but of highly advanced design" as a part of its program for an integrated, national petrochemical industry.

Creole Petroleum Corp. plans to boost the capacity of its 6-year-old, 158,000 b/d refinery at Amuay, Venezuela, to a whopping 500,000 b/d by 1960—second only to Abadan, Iran (rated at 550,000 b/d but currently running only at half capacity). Details of the Amuay expansion project were not released.

. . . the East:

Idemitsu Kosan Co. is building a 20,000 b/d refinery at Tokuyama, designed by Universal Oil Products Co.

Arabian American Oil Co. has an $80-million capital expenditure budget for 1956, including production, pipelines, living facilities for personnel in Saudi Arabia, and a 15,000 b/d Hydrofiner located at Ras Tanura.

in Markets and Prices

. . . Gasoline prices generally were firm for June in primary supply markets. But firm off-season prices for heating oil were perhaps more heartening to refiners. Both light and heavy fuel prices held at mid-winter levels.

Contract shipments of motor fuels were sufficiently heavy to keep supply and demand in balance. At least there were no onerous open market offerings, despite a disappointing decline in inventories for the season.

. . . Distillate stocks started their summer buildup from the lowest base since the 1947-48 heating season. Despite substantial additions late in May and early in June, inventories of kerosine and distillate fuels (combined) were still 11.9-million bbl under the year-earlier level.

. . . Steel strike possibility tended to back up heavy fuels in the Mid-Continent and Midwest, but prices held steady in those areas. In the East and West, there was no easing of supplies. Low sulfur resid prices even moved up 5¢/bbl in some northern Atlantic seaboard districts.

. . . Pennsylvania lube oils rose another 1¢/gal following 25¢/bbl boost in crude prices by South Penn Oil Co. Pennsylvania bright stock reached 26¢/gal, and 200 vis. neutral, 22.5¢. Lube demand was brisk in Mid-Continent and at the Gulf, but there was little disposition to raise prices.

. . . Two localized crude price reductions indicated over-supply of oil in the areas involved. Wyoming and Montana sweet crudes were cut 7¢/bbl to meet competition from the Denver-Julesberg Basin. Sohio Petroleum Co. cut Illinois Basin prices 10¢/bbl.

Looking Ahead

. . . Auto air conditioners and other heat-generating accessories may limit volatility of motor fuels, and some car models may have trouble with fuels of current volatility, Humble Oil & Refining authorities believe.

Humble's tests showed that Reid Vapor Pressure fuel limits were reduced an average of 0.7 lb when air conditioners were operated. They estimate 10% of all cars will be air conditioned by 1961, and 33% of the new models.

. . . The best way to stop industrial air pollution is not to let it start—or so thinks the Houston, Tex., Chamber of Commerce. The Chamber has retained the Southwest Research Institute of San Antonio to make a comprehensive two-year study of air pollution conditions in the Houston industrial area. The goal of the farsighted project is prevention of any future smog problem.

difficult physical conditions, but...

India's largest refinery was completed a year ahead of schedule

The 40,000 B/D refinery of Burmah-Shell Refineries Ltd. near Bombay, India is the country's largest. It is capable of supplying an estimated half of India's current requirements for finished petroleum. Although built in the face of difficult physical conditions, close cooperation with the owner in planning and engineering, and exceptional coordination of construction allowed Lummus to finish almost a year ahead of the original schedule.

A smoothly running refinery now, consisting primarily of crude distillation, fluid catalytic cracking, gas recovery, treating and blending units, offsite facilities and utilities, at the start it was only 450 acres of incredibly difficult terrain, without roads, railway or harbor.

Battling two of Bombay's worst monsoons, Lummus employed as many as 14,000 Indians at peak periods. Terrain was filled and drained. Roads, rail lines, harbor facilities, and the complete refinery were constructed. The job was kept moving *ahead* of the timetable — and finished 21 months from the start of construction.

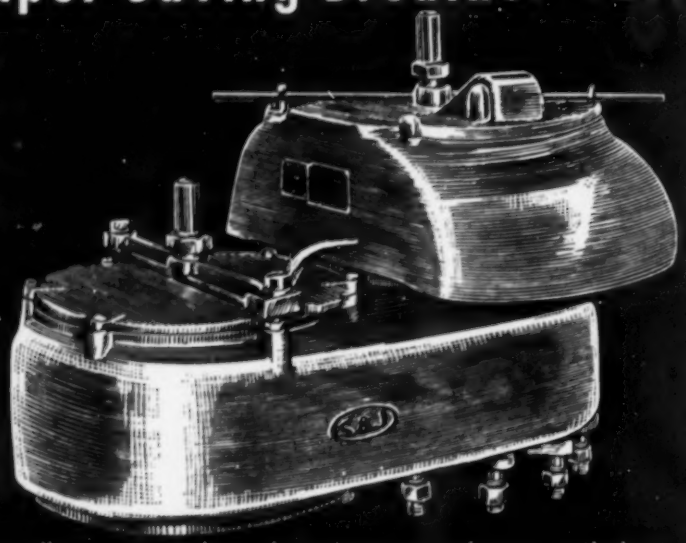
A project of this magnitude requires a worldwide organization of experienced engineers and construction men able to cope with any problem. Lummus is such an organization and can design and build your next plant whatever the size, type or location.

The Lummus Company, 385 Madison Avenue, New York 17, New York. *Engineering and Sales Offices:* New York, Houston, Montreal, London, Paris, The Hague, Bombay. *Sales Offices:* Chicago, Caracas. *Heat Exchanger Plant:* Honesdale, Pennsylvania. *Fabricated Piping Plant:* East Chicago, Indiana.

LUMMUS

ENGINEERS AND CONSTRUCTORS FOR INDUSTRY

The COLD FACTS on
TITE-SEAL
Vapor Saving Breather Valve



★ Maintains an excellent vapor tight seal at pressures and vacuums below valve settings.

★ Tight seal against leakage is accomplished by a novel balancing action on which patents are pending.

★ High flow capacity—pops wide open—not a mere crack—at relatively small pressure or vacuum beyond valve setting.

★ No valve can prevent evaporation in the cone roof tank range, but this valve MINIMIZES LOSSES greatly.

★ Prevention of losses from standing storage at vapor space working pressures is just as important as over pressure capacity.

★ TITE-SEAL Vapor Saving Breather Valve saves even the vapors which were formerly accepted as expendable.

★ Designed expressly for vapor conservation systems—it's the KEY to profitable operations—a MUST for conservation systems.

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Wanted Today: A New Kind of Instrument Technician

SOMEONE once said, "Progress is change—if there is no change there is no progress."

Well, there is no doubt that the petroleum processor is seeing plenty of progress in today's refinery—in equipment, processes, and especially in instrumentation. Today's refinery and petrochemical plant now includes everything from the simple ammeter to the complex computers and process analyzers mushrooming everywhere. Many other new instruments are also rapidly moving from lab to plant.

In the past, instrument maintenance involved mainly a screwdriver and other simple tools. Almost any man with reasonable intelligence and a little training could grasp the simple principle behind an ammeter or a pressure bellows.

Now, however, the fellow on the other end of the screwdriver must understand complicated physical principles, too.

Often, it requires two men to keep a complex instrument working: a mechanic who knows how to use a screwdriver and an engineer who knows how the instrument works. Expensive and complicated instruments, like mass spectrometers and infrared analyzers, earn money only when they work. Efficiency requires maintenance of these instruments by a single person who can not only diagnose the sickness but can quickly get the instrument back on the job.

Finding or creating this new technician will not be easy, and someone's toes may be stepped on. There are two ways to do it [1] but the door to one is nearly closed. Instrument technicians have always tried to keep up with latest developments, learning the most exacting techniques of mechanics, hydraulics, pneumatics, electronics and even petroleum processes. But there's a limit. The average instrument mechanic can hardly expect to become an expert physicist.

The alternative is to hire technicians specially trained in physics, teaching them how to use tools and make repairs. This will mean selecting personnel on ability rather than seniority. Extra compensation will probably be involved. And dominance of these technicians by any organized group will be unsatisfactory. Yet, a way must be left open to upgrade worthy and capable instrument mechanics to the new level, because there are some who will be willing and able to meet the higher requirements.

Progress in petroleum processing means changes in instrument maintenance as well as changes in the instruments themselves. As more highly specialized instruments are used for controlling processing operations, instrument technicians of matching caliber will be required. The "Help Wanted" sign is already out.

—W. A. B.

(1) "Instrumentation of Petroleum Processes," a paper presented by J. G. Kerley, Shell Oil Co., before the Midyear Meeting of the API Division of Refining, Montreal, Que., Canada, May 15, 1956.

Some Light on Tomorrow's Processing Plant Lighting

TOMORROW'S refineries are going to be showpieces, and they're going to be lit up like showpieces. Designers are learning that the same lighting equipment that brings out the powerful beauty of a modern industrial landscape can replace less efficient, less safe equipment.

Lighting practice in refineries is changing now, will change still more tomorrow under the twin pressures of good public relations and greater efficiency. Though the basic lighting job will always be providing enough illumination to work by, good lighting can handle a number of other valuable assignments:

Prevent accidents to personnel and property
Keep intruders out
Lower maintenance costs
Boost personnel morale
Add beauty to the community

The future refinery will probably use many more fluorescent fixtures than its present day cousin. For the same amount of electricity, fluorescents provide more attractive light in greater quantity than incandescents.

In such showplaces as control rooms, fluorescents are being recessed into hung ceilings. And the availability of standard sized vapor proof fixtures for modern lighting applications is making replacement of older equipment easy.

Future lighting installations will be a fair match for corrosive refinery atmospheres. Expensive bronze and more economical galvanized fittings will protect fixtures in tough areas. And designers will make sure that all components—reflectors, wiring plugs and sockets, as well as the fixtures themselves—are corrosion resistant.

Automatic units for strategic points, some hermetically sealed, others explosion proof, are being powered by trickle chargers, eliminating manual controls.

—A.C.

Will Computers—Brilliant Morons—Bring New Life to Processors?

AUTOMATIC computers are no longer novelties to the petroleum processing industries. Hardly a week passes without announcement that another company has started a computer program. Recent meetings of technical and industry societies have loosened a flood of papers on this hitherto "mum" subject. Several of these papers were reviewed in last month's PETROLEUM PROCESSING, pp. 61-71.

Why are computers used? Two main advantages appear uppermost in the minds of computer users. Firstly, they make possible studies and calculations never before practical by plodding hand calculation methods. Secondly, they can serve as an aid to decision making in operating and management problems. While few think that computers will "save" money for a com-

pany, many think they will "earn" money by making more efficient plant operations.

Computers are used in many ways. Computer-prone problems cover the gamut from reduction of mass spectrophotometer data to mathematical simulation of entire refineries. Computers can correlate data, design equipment, evaluate pilot plant processes, estimate costs, determine process operations, predict markets and supplies, and a veritable host of other duties.

However, the dream of the automatic refinery, run by push button and computer, is not just around the corner. Isolated units or processes can be computer controlled if the user is willing to expend the effort and money needed to develop data, correlations and computer programs.

The drawback is that computers are morons. A simple earthworm has many times the "brain cells" of our most complicated electronic computers. An idiot child has more brain cells than all the computer valves and tubes used during the history of automatic computers.

The computer is no better than its "masters." It cannot do any act of reasoning, judgment or thinking not specifically built into it by its maker, or programmed into it by its user. Every minute action, choice or function of a computer must be anticipated by a human brain ahead of time.

Processors must know a lot more about processes and reactions, freeing themselves of empirical chains and "seat-of-the-pants" operations, before they can teach the not too bright—but swift and obedient—computer to do all their work.

The need for better process understanding now becomes an increasingly important challenge to theoreticians and designers alike. The more we know of the "why" and "how" of petroleum processing operations, the nearer we are to optimum operations by computer "guidance." —R.L.D.

Turbine Auto Is All Dressed Up But Has it Any Place to Go?

PROGRESS in improving the gas turbine for automobiles was reported by the General Motors Research staff in papers delivered at the summer meeting of the Society of Automotive Engineers in Atlantic City, June 3-8. GM has carried on experimental work in its laboratories as well as with test units in traffic.

A dramtic touch was added to the current report by the exhibit and demonstration of the newest model installed in a special chassis designed by GM engineers for housing a gas turbine engine. Low, sleek and shining, with a cigar-shaped front and a tail fin, this car attracted great attention on the streets of Atlantic City. It was driven in from Detroit and had been stopped several times by curious state police.

The new GT-304 Whirlfire turbine engine (Firebird II) was built to overcome the recognized shortcomings of earlier models, particularly high fuel consumption and sluggish acceleration between idle and 70% gasifier speed. The design rating is 200 hp at a gasifier speed of 35,000 rpm and turbine inlet temperature of 1650°F. Rated power turbine speed is 28,000 rpm with an overspeed allowance to 35,000 rpm. A 7.27:1, three-step, helical reduction gear takes the output shaft speed down to a normal engine range. The weight of the original engine buildup is 850 lb, including two drum-shaped rotating heat exchangers. These are a new design feature of the current model. Weight of the regenerator is approximately 0.75 lb/hp.

Acceleration performance has been improved through new design and the use of new materials in the gasifier, as well as by coupling the power turbine to a transmission with several speed changes. Fuel consumption has been reduced at least 50% from that of earlier models, it was said. Fuel used ranges from commercial fuel oils to motor gasolines.

Several unusual features are used in the installation of the engine in the showy experimental chassis. The engine is mounted in the conventional forward location, but the transmission is behind the passenger compartment, in line with the rear wheels. The larger power absorbing accessories are mounted on the transmission and driven from the input shaft.

A dual exhaust system is provided, with four outlets. Two idling exhaust vents run forward through the chassis sill members and then upward to vents on each side of the body, just behind the passenger compartment canopy. Under road load conditions, these are augmented by two additional vents directly under the engine.

Two of the experimental chassis were built for the new GM engine. One has a titanium metal skin and the other has glass fiber reinforced plastic body panels. The car demonstrated at Atlantic City did show the automotive engineers that more than the engine itself is required for commercial gas turbine powered automobiles. For this, among other reasons, less enthusiasm was shown than at previous SAE meetings where such turbine engines were discussed.

One comment from the floor following the presentation of the GM reports seemed to sum up the feeling of the audience: "This is more the Car for the Day After Tomorrow than the Car for Tomorrow."

—V.B.G.

. . . and Nuclear Powered Cars Seem as Yet Superman Fiction

AUTOMOBILES propelled by atomic energy also were discussed at the SAE meeting to explore:

- How small should the power source be?
- How much shielding is necessary?
- Would a "life-time" fuel source be included as part of original purchase price of a car?
- How much will fuel cost and is it available?
- What performance gains are possible?

An answer to the fuel costs showed that nuclear fuel would have to sell for about $13/gm to compete with normal hydrocarbons at an average of 2.5¢/mile in a car driven 160,000 miles.

The two big problems were how to handle the heat from a nuclear engine, and the matter of safety. Atomic cars are still a long way off. —V.B.G.

customer reports prove

Big Savings with . . .

OCECO V-130 Conservation Regulators

Exclusive construction assures tight leak-proof closure fully up to operating setting — quick opening — and extremely high flows even at low pressures.

Oceco V-130 Conservation Regulators provide **greater flow capacity**, size for size, and pressure for pressure, **specially at low pressures** than **ever available before.** Our exclusive construction prevents vapors from escaping at less than set operating pressures. Positive flexing action of the membrane, held under tension, peels off and breaks away any icy formations, preventing freeze-ups. These valves bring never before secured **all weather** economy and dependability to the conservation of volatile products stored in cone, round, flat, lifter or expansion roof tanks. **Write for Bulletin No. 522. It gives full details!**

PRESSURE BALANCED CONSTRUCTION.

Tank pressures exerted on both sides of the pliable heat and cold resistant membrane keep membrane always under tension; —assuring tight seating fully up to operating setting— and positive flexing action that peels away icy formations preventing freeze-ups.

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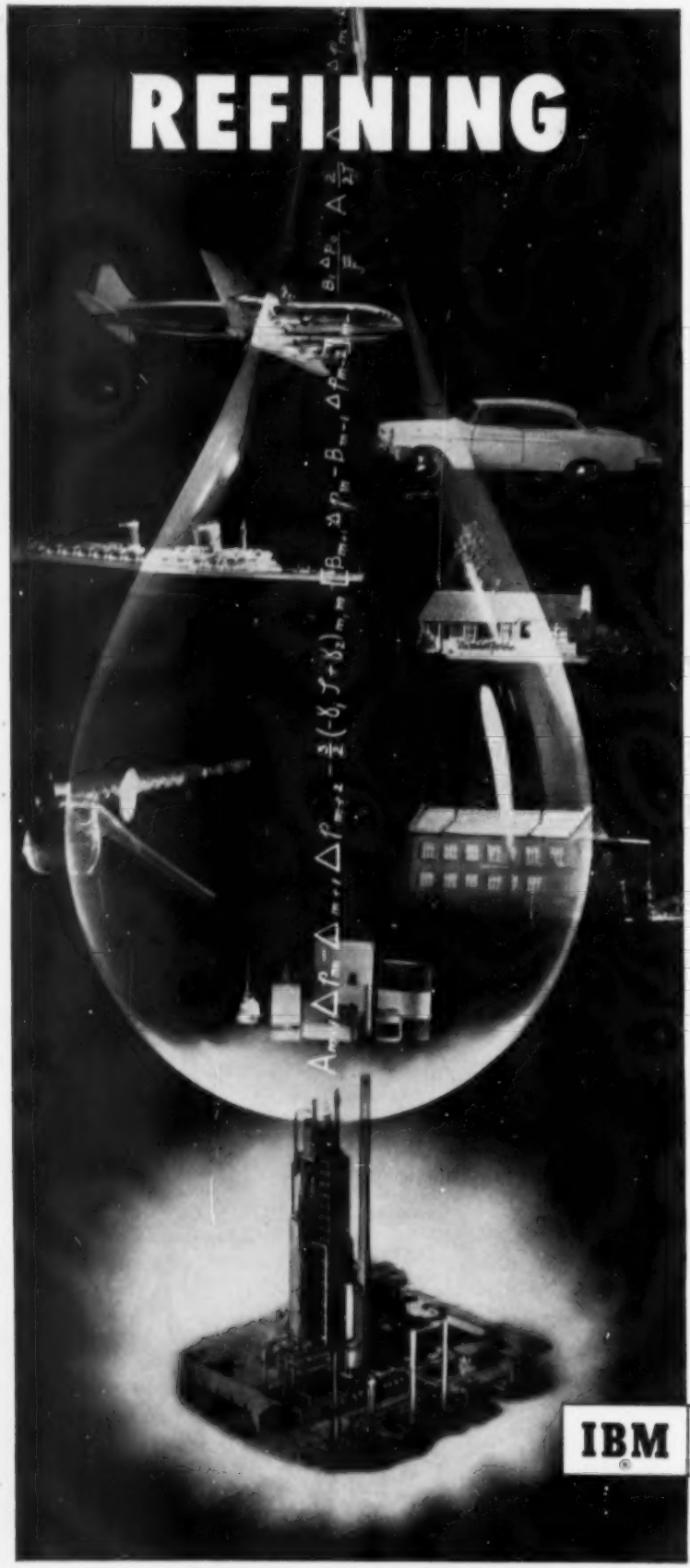

. . . and IBM electronics

Speed . . . speed . . . speed!!
Speed in pinpointing and forecasting market demands for petroleum products!
Speed in shifting refinery operations to meet these demands!
Speed in determining mix formulas to produce the *right* products at the *right* time!

Yes, the speed and accuracy of IBM Data Processing Systems have proved to be turning points toward greater efficiency and profits by many refineries.

One refinery, for example, using the IBM 650 "electronic workhorse" on a daily basis for Gasoline Blending, estimates a saving of ½¢ per barrel!

Another producer, using one of IBM's Data Processing Centers for Refinery Simulation, is now able to reschedule operations in minutes, rather than days, —to meet market forecasts.

In another instance, several refineries were able to switch Chemical Engineers to more vital work. Formerly, it required 2 or more of these engineers' full time to make Mass Spectrometer Calculations. Today, this job is done on the IBM 650 . . . in 20 minutes!

Here is a partial list of other proven applications of these machines:

- Crude Oil Analysis and Evaluation
- Product Outlook
- Refinery Scheduling
- Yield and Cost Calculations
- Correlation and Multiple Regression Analysis
- Flash Vaporization
- Catalytic Cracking and Thermal Cracking Calculations
- Reactor Design
- Acid Distribution and Consumption

For detailed information on how IBM electronics will profit your refinery, call your local IBM representative today, or write: PETROLEUM DEPARTMENT A56, International Business Machines Corp., 590 Madison Ave., N.Y. 22, N.Y.

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MARKETING

DATA PROCESSING • ELECTRIC TYPEWRITERS
TIME EQUIPMENT • MILITARY PRODUCTS

(To obtain more data on advertised products see page 178)

Letters

A $64,000 Question?

To The Editor: We have read with interest your presentation in Petroleum Processing on the question and answer session recorded at the October, 1955, meeting of the Western Petroleum Refiners Assn. in El Dorado (May, 1956, pp. 65-69).

Of particular interest to us was the question raised by Mr. Alexander of Pan-Am Southern Corp., regarding field experience of "microspheres" in the protection of cat cracker and cat reformer feed stocks. Since Mr. Wheeler, the moderator, was unable to get any comments from the floor on this "$64,000 Question," we would like to comment and perhaps spread some light on this Microballoon application.

At the present time, to our knowledge, no one has yet blanketed cat reformer or cat cracker feed tanks with Microballoons to prevent oxygen contamination and subsequent exchanger fouling.

However, we have carried out pilot plant work using Microballoons on both virgin and cracked reformer feed stocks, the results of which have been encouraging enough to warrant actual field application of the Microballoon foam for this purpose.

Accordingly, we intend to Microballoon blanket four cone-roof, reformer feed tanks which will provide both virgin and cracked naphthas for our new Cleveland reforming unit.

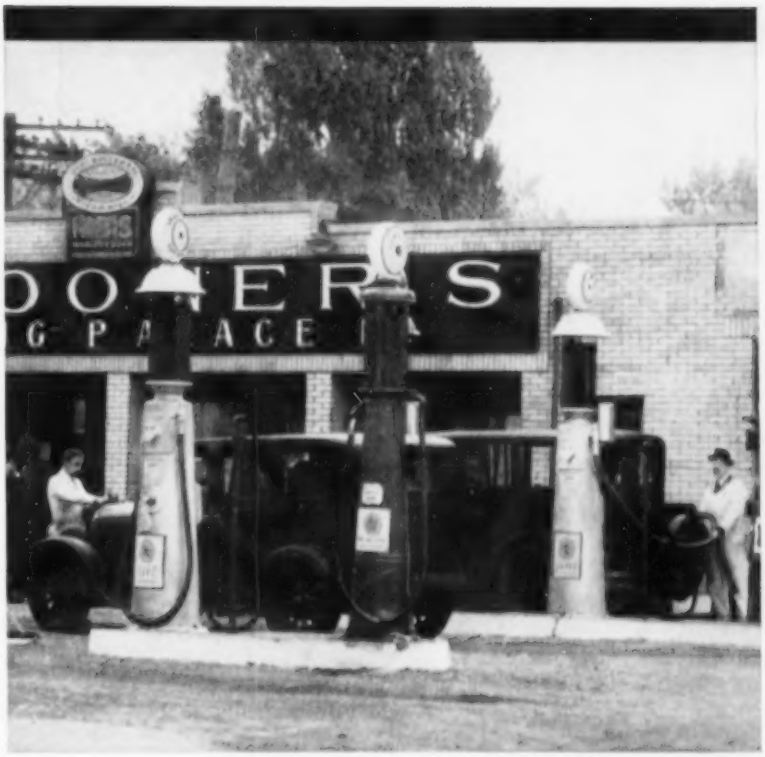
We plan to bring this new unit onstream sometime late in June. By the end of the summer, we hope to have preliminary field data on this new use of Microballoons. Will this question still be worth $64,000 at that time?

John Dempster
Standard Oil Co. (Ohio)
Cleveland 15, Ohio

• *We can't answer reader Dempster's last question on the worth of this question by the end of this summer, but for more information on Microballoons as well as on other methods for reducing costly evaporation losses, we suggest you turn to the special report beginning on page 103 of this issue.*

The Whiting Plug Valves

To the Editor: In our report on the explosion at Whiting last August, which your publication printed ["What



Since "way back when," Monsanto has been helping processors like you with the chemical problems of petroleum modifiers

Modern Example:
CONTROLLING THE CORROSIVENESS OF LIGHT PETROLEUM FRACTIONS

The problem, of course, was to find an inhibitor — one that in very, very low concentrations would keep light distillates from chewing up metal. It took some searching — but Monsanto chemists came up with Santolene C; just .0015% of it in the stock cut scale formation in a cargo tanker by 2 tons per month.

When you want a base stock modified to meet laboratory specifications before starting expensive field testing . . . send the base stock and your specifications to Monsanto. Monsanto can supply you with Chemical Additives for almost any job an additive can do: Corrosion inhibitors • Detergents • Viscosity index improvers Gear lubricant fortifiers • Fuel oil clarifiers • "Oiliness" improvers.

For more information, write to:
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St. Louis 1, Missouri

MONSANTO

Santolene Reg. U.S. Pat. Off.

(To obtain more data on advertised products see page 178)

at the frontiers of progress you'll find . . .

COLFOAM MICROBALLOON* spheres cut waste of stored crude oil and products

Until the development of Colfoam Microballoon Spheres, cone-roof tanks were extremely wasteful of stored crude oil and products. In fact, these tanks were more like uncorked bottles — so far as controlling evaporation was concerned.

Then Colfoam Microballoons entered the picture. Years of testing and actual experience prove that a blanket of Colfoam Microballoon Spheres reduces costly evaporation losses by as much as 86%. Colfoam Microballoon blankets are easily installed, require no upkeep and soon pay for themselves through money-saving conservation of crude oil and products.

"Bought by the pound and used by the fraction of an inch," urea formaldehyde Colfoam Microballoons are microscopically-small, gas-filled spheres which float on top of crude oil and products and form a foam-like seal.

Buyers of Colfoam Microballoon Spheres enjoy many advantages from Colton Technical Service at no additional cost. Surveys, made prior to purchase, estimate what savings can be expected and how much material is needed. Following supervised installations, actual savings are determined. A Portable Gage Tape Well that aids in accurately measuring stored material and a Foam Sampler that measures foam thickness are supplied as well as complete technical bulletins.

Write today for full information on Colfoam Microballoon Spheres and for proof of substantial savings through drastic reduction of evaporation losses.

*COLFOAM Reg. T. M. Colton Chemical Co. MICROBALLOON Reg. T. M. Standard Oil Co. (Ohio)

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Products of other divisions of Air Reduction Co., Inc. include; AIRCO — industrial gases, welding and cutting equipment PURECO — carbon dioxide, liquid-solid ("DRY-ICE") OHIO — medical gases and hospital equipment NATIONAL CARBIDE — pipeline acetylene and calcium carbide.

Happened at Whiting?", PP, Jan. '56, pp. 39-44], reference was made to "leaking catalyst plug valves."

Since then, it has come to our attention that some readers might have been misled into thinking we were talking about conventional plug valves and cocks. Such is not the case.

The valves at Whiting, we wish to emphasize, were highly specialized in both purpose and design. They were not stock items in any sense, but were specially designed and custom-built for use in the Fluid Hydroformer reactor.

Accordingly, the terminology of our report was not intended to cast any adverse reflections on conventional plug valves and cocks, and should not be so interpreted.

DON CAMPBELL

Director of Public Relations
Standard Oil Co. (Ind.)
Chicago, Ill.

It's PeNex, not PeMex

TO THE EDITOR: (*Note: this was really a telephone call, but it concerns a typographical error in our June issue, p. 9, and, therefore, should be called to the attention of the reader*). We would like to point out that the new isomerization process of Universal Oil Products Co., designed to upgrade pentane and hexane fractions and to produce a high octane product of high volatility, has been trade-named "Penex"—with an "n." Your news paragraph in the June issue of PETROLEUM PROCESSING erred in spelling it "Pemex."

D. P. THORNTON, Jr.

Public Relations Dept.
Universal Oil Products Co.
Des Plaines, Ill.

"Now let's try some on the rocks, hmm?"

(To obtain more data on advertised products see page 178)

NEW DULUX® TANK WHITE ENAMEL

offers greater savings than ever!

Improved gloss and reflectance value keeps tank interiors cooler . . . reduces evaporation losses even more

Over 25% higher build (without sagging or wrinkling) lengthens painting cycles . . . reduces repainting costs

Harder, faster drying minimizes bug and dirt collection

Improved mildew resistance means retained whiteness

Over 20% higher hiding—starts whiter . . . stays whiter

Now, from Du Pont laboratories, comes a *new* DULUX Tank White Enamel that offers even greater savings for the petroleum industry! This new DULUX, in addition to these important improved properties, is still the durable white enamel that reflects the sun's rays with maximum efficiency . . . *keeps* tank interiors cooler to protect both the quality and quantity of stored products. Refineries report DULUX actually cuts evaporation losses as much as 80%!

And with new DULUX Tank White you can apply two coats of paint in one operation—the second sprayed at right angles immediately after the first. With only one scaffold setup, you save on time and application costs. New DULUX resists corrosion, industrial gases and rough weather, too, because it's chemically engineered to do the job better, year after year. For further information on the many ways new DULUX Tank White can save money for you, mail the coupon today!

DU PONT

REG. U. S. PAT. OFF.

Petroleum Industry Finishes

Du Pont has the *right* finish for *every* petroleum industry need

PRODUCTION · PIPELINE · REFINING
MARKETING · MARINE

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

SEND FOR FREE BOOKLET. BEAT THE HEAT is an informative, illustrated booklet that tells how Du Pont DULUX Tank White Enamel can help you save money. Send for your free copy today.

E. I. du Pont de Nemours & Co. (Inc.)
Finishes Division, Dept. PP 67, Wilmington 98, Del.

Please send me, free of charge, your illustrated booklet BEAT THE HEAT.

Name _____

Title _____

Firm _____

Address _____

City and State _____

(To obtain more data on advertised products see page 178)

THREE MEN AND A BUOY

in Search of Oil

The men are Cities Service geologists, the buoy a marker used in undersea oil exploration.

That this search involves great expense, everyone agrees. That it will prove successful, no one can guarantee—since the odds for exploratory drilling are nine to one against a discovery. The Cities Service oil seekers, however, continue to chalk up impressive records in both land and sea exploration. Records such as 1955's one-out-of-three success ratio for test wells . . . far above the ratio for the oil industry.

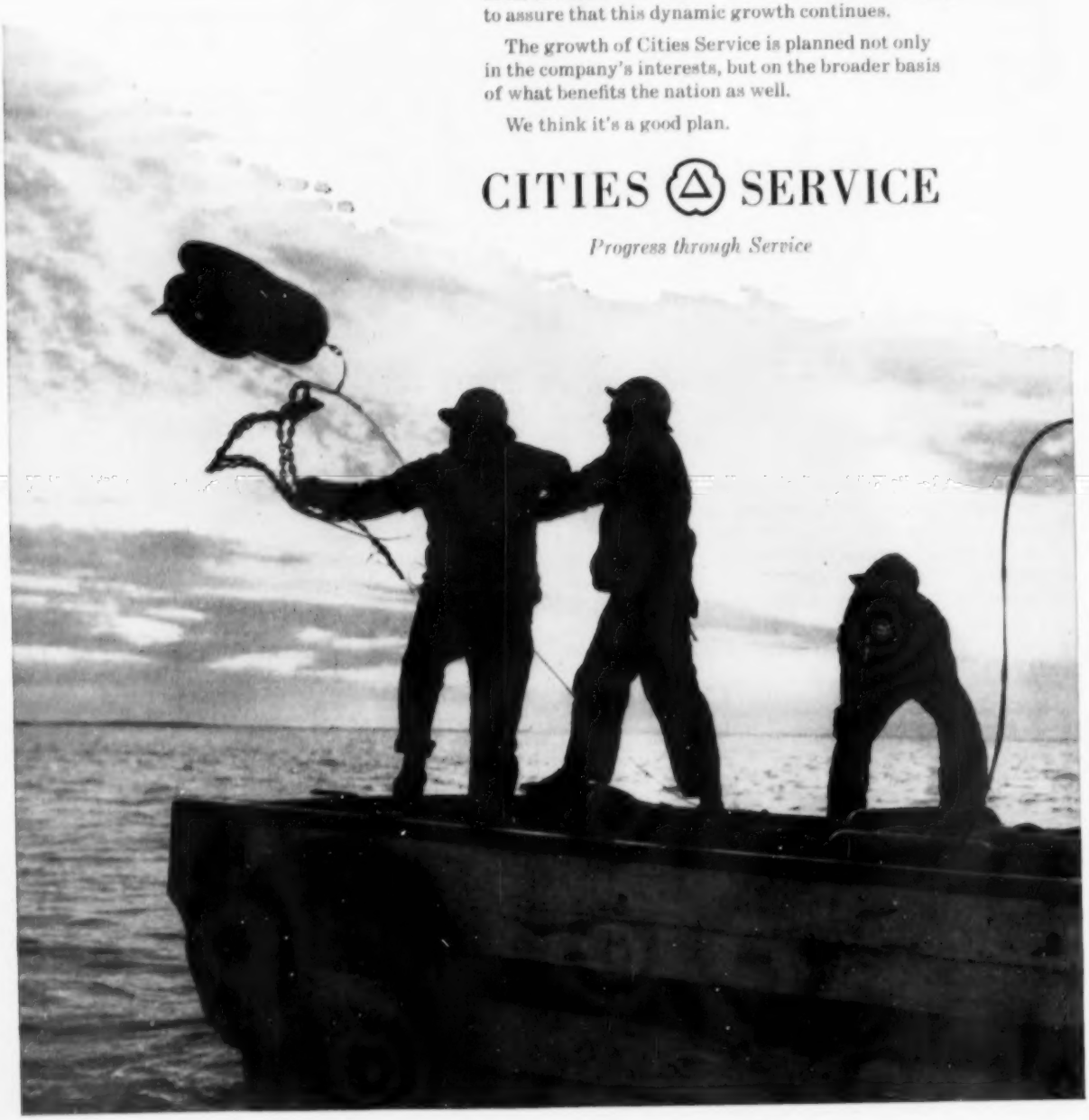
Here are other 1955 records: A new peak in production and sales of petroleum products, with sales up 17% . . . a 6% increase in natural gas sales . . . an all-time high in stockholders' equity . . . construction of an ultramodern Cities Service research laboratory to assure that this dynamic growth continues.

The growth of Cities Service is planned not only in the company's interests, but on the broader basis of what benefits the nation as well.

We think it's a good plan.

CITIES SERVICE

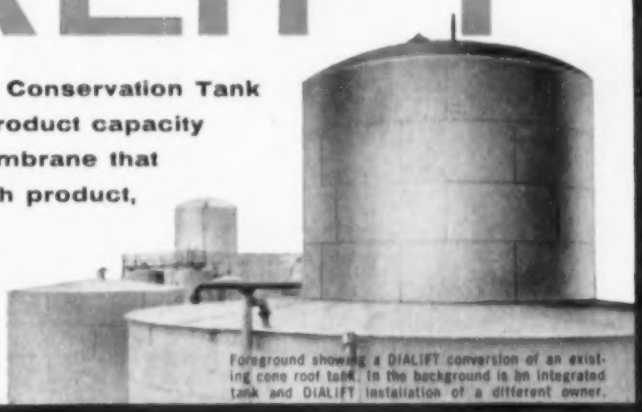
Progress through Service



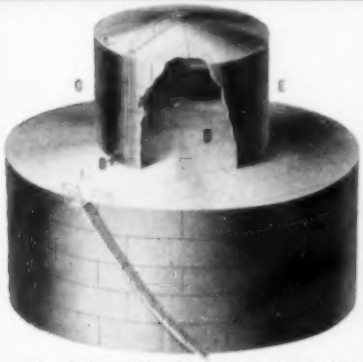
(To obtain more data on advertised products see page 178)

The HAMMOND
DIALIFT

The ONLY membrane type Conservation Tank with full-rated vapor and product capacity AT ALL TIMES, with a membrane that cannot come in contact with product, vapor space that can be isolated for inspection and maintenance without taking product storage tank out of service.



Foreground showing a DIALIFT conversion of an existing cone roof tank. In the background is an integrated tank and DIALIFT installation of a different owner.



Principle of the Hammond Dialift

A— DIALIFT DIAPHRAGM rises and falls to accommodate expanding and contracting vapor.
B— Vapor passes to and from tank and DIALIFT through simple elbow connection.
C— DIALIFT and tank have full-rated capacity.
D— Membrane can't come in contact with product.
E— DIALIFT can be isolated for maintenance and inspection, product tank stays in service.

The most efficient and economical vapor conservation system for new or old tanks.

THE HAMMOND DIALIFT consists of a gas-tight Vulcalock membrane attached to the inside periphery of a cylindrical metal housing to become a "breathing" apparatus to accommodate the expanding and contracting vapor as developed in product storage tanks. The DIALIFT can be used as a single conservation unit by being attached to the roof of a product storage tank or as a central "breathing" system by being manifolded to a number of product storage tanks. There are two forms of installation: —Ground type manifolded to a number of tanks to form a conservation system and integrated type whereby the DIALIFT is attached to the roof of a product tank for vapor conservation for one or a number of tanks.

The DIALIFT is completely isolated from the product storage tank. Vapor passes between the tank and DIALIFT through a vaporline connection. It is easy to convert old cone roof tanks to efficient vapor-saving DIALIFT installations by attaching a DIALIFT housing with membrane to the roof of the old tank and connecting the vaporline between the tank and DIALIFT.

New or converted DIALIFT tank, inter-connected with cone-roof tanks, becomes central "breathing" unit.

DIALIFT GROUND UNIT serves as central "breathing" apparatus of multi-tank conservation system.

THE HAMMOND DIALIFT ELIMINATES BREATHING LOSS AND REDUCES FILLING LOSS

Write for catalog 55DL

HAMMOND IRON WORKS

WARREN and BRISTOL, PA. • PROVO, UTAH • CASPER, WYO. • BIRMINGHAM, ALA.

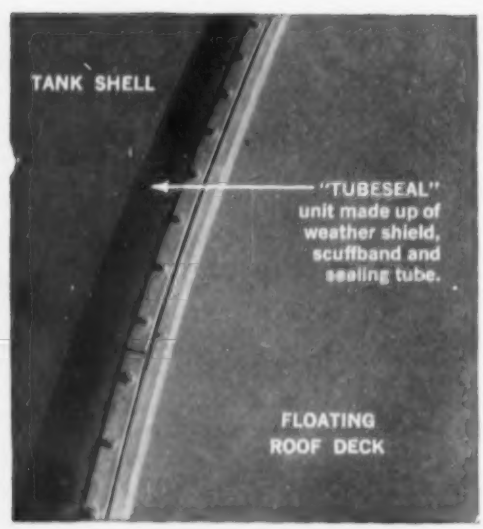
Sales Offices: NEW YORK 20 • AKRON • BOSTON 10 • BUFFALO 2 • CHICAGO 3 • CINCINNATI 2 • CLEVELAND 15 • EL PASO • HOUSTON 2 • LOS ANGELES 14 • PITTSBURGH 19 RICHMOND 20 • SAN FRANCISCO • WASHINGTON 6, D.C. • HAVANA • "TIPSA" BUENOS AIRES

RESULTS CONVINCED

In 1954 the "X" Company* bought

TO DATE THEY HAVE PURCHASED 20 ADDITIONAL TUBESEALS

...on the basis of proved performance!



Looking down on Hammond Tubeseal in position on Floating Roof tank. Neoprene weather shield and ribbed scuffband protect oil-filled sealing tube, which is in continuous contact with product, thereby eliminating vapor space.

* **One of the nation's largest oil companies. Name on request.**

† **Patented**

UNUSUAL? No, merely typical of the many new users who are adding fresh chapters to Tubeseal's exciting "success story." And no wonder! Tubeseal is the **only** floating roof that eliminates vapor space while providing a **positive** seat at all points between the roof, shell and product. No vapor-air mixture can lurk above the product—because there is no space for vapor to form.

Think of the advantages this offers! Regardless of the product you are storing—vapor losses simply can't occur. And with products of intermediate volatility, such as jet fuels, the dangers of exploding vapors and rim fires are practically non-existent.

NO CORROSION
NO MECHANICAL MAINTENANCE
CLIMATE PROOF

In contrast to conventional metal shoe seals, where rusting and corrosion shorten seal life and create contamination, the Tubeseal is completely non-corroding. Nor will it scuff, abrade or injure the interior tank surface. And because it has no moving parts, there is no mechanical maintenance required.

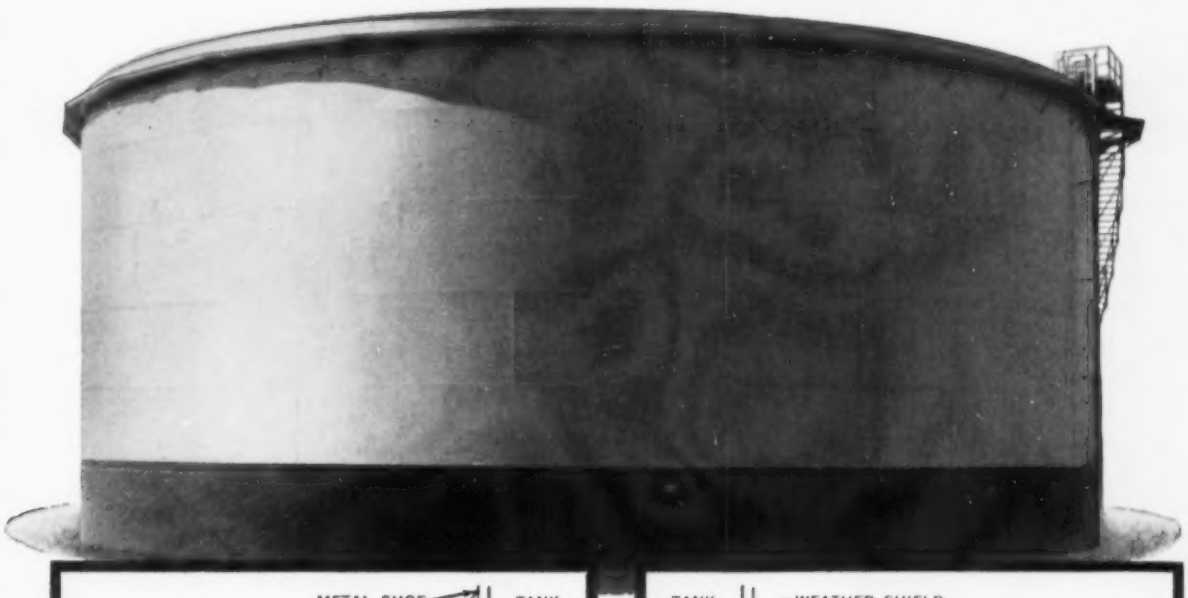
Tubeseal Floating Roofs can be efficiently used on all types of new and existing tanks—even those of riveted construction where metal shoe seals are particularly inadequate. The liquid-filled tube quickly adjusts to irregular shapes, overcoming any tank out-of-roundness.

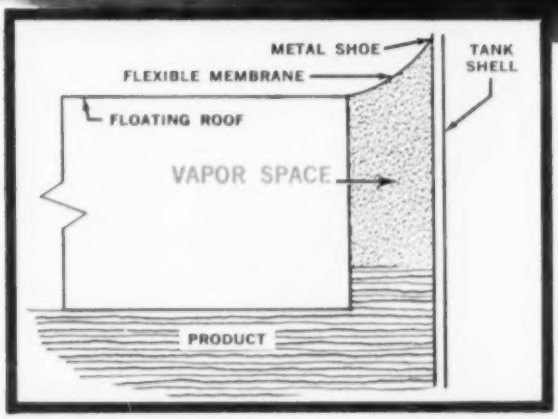
Whether you are storing gasolines, jet fuels, sour crudes, light crudes, alcohol, naphthas, polyesters or similar products, Tubeseal is **the most efficient and positive seal known.**

BUILT TO YOUR SPECIFICATIONS...GUARANTEED TO YOUR SATISFACTION!

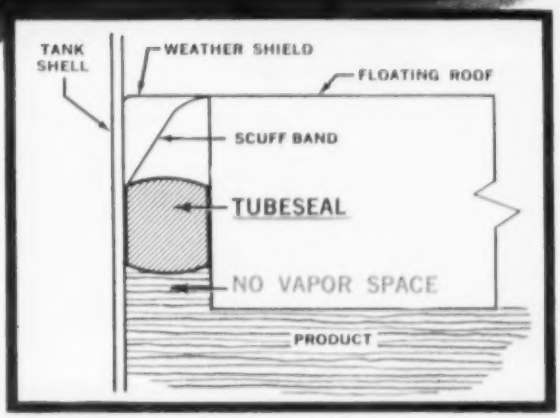
THIS MAJOR REFINER*...

ONE Tubeseal† Floating Roof Tank





Conventional floating roof tank has space between flexible membrane where air-vapor mixtures form. Because metal shoe and membrane cannot be absolutely gas tight, vapor is constantly escaping. This condition causes excessive corrosion, may also result in fire from lightning or other source.



HAMMOND TUBESEAL FLOATING ROOF entirely eliminates every space where air-vapor mixtures can form. **Hammond Tubeseal** completely fills space between product surface and roof seal, so that corrosion is stopped (even for sour crudes), and vapors **cannot form—hence cannot ignite or be lost.**

HAMMOND TUBESEAL — THE MOST EFFICIENT AND POSITIVE SEAL KNOWN

HAMMOND IRON WORKS

WARREN and BRISTOL, PA. • PROVO, UTAH • CASPER, WYO. • BIRMINGHAM, ALA.

Sales Offices:

BOSTON 10, MASS. • NEW YORK 20, N. Y. • CINCINNATI 2, OHIO • CHICAGO 3, ILL. • WARREN, PA. BRISTOL, PA. • ARLINGTON, VA. • GREENVILLE, S. C. • BIRMINGHAM, ALA. • SAGINAW, MICH. SAPULPA, OKLA. • PROVO, UTAH • CASPER, WYO. • LOS ANGELES 57, CALIF. • HAVANA • MEXICO CITY "TIPSA," BUENOS AIRES • CAIRO, EGYPT • PORT-AU-PRINCE, HAITI • LIMA, PERU

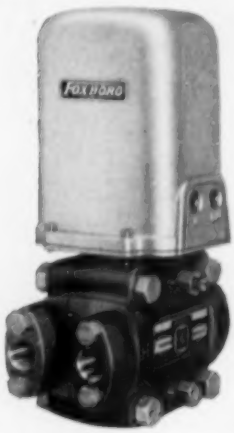
Licensees: CALIFORNIA, CANADA, ENGLAND, BELGIUM, GERMANY, ITALY, FRANCE, JAPAN

GET THE BEST SOLUTION TO EVERY FLOW

. . . with Foxboro Instrumentation

Differential Pressure Cell Transmitters

Complete line includes air-operated and electric-operated d/p Cell Transmitters covering ranges from 0-25" to 0-800" of water; working pressures up to 1500 psi.



Type 13A d/p Cell Transmitter

- Positive Overrange Protection—up to full 1500 lb. rating
- Fully Adjustable Ranges—0-20" to 0-80" and 0-50" to 0-250" water
- Automatic Internal Damping — fast, stable measurement
- Simplicity—easiest, lowest-cost installation, lowest maintenance

Mercury Type Meters

Complete line includes mercury types covering ranges from 5 to 400" of water; working pressures up to 5000 psi.

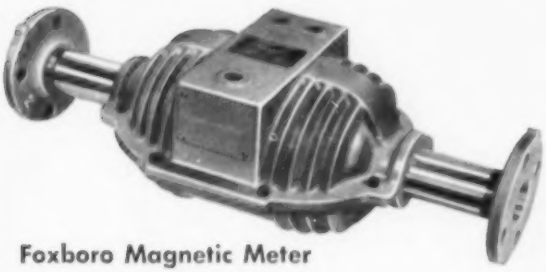
Type 28 Mercury Meter

Permanent Full-Scale Meter Accuracy — exclusive segmental lever design provides linear transmission

Highest-Powered Pen Drive — large float with long travel

Minimum Ambient Temperature Effects — float located in high pressure chamber

PROBLEM



Foxboro Magnetic Meter

- Measures Fluid Velocity Directly
- Adds No Pressure Drop
- Uniform Flow Scale
- Overall Accuracy Better than 1% of Range Over Entire Scale
- Full Accuracy Sustained Even on Liquids Other Meters Can't Handle — even sand and water slurries

THERE ARE two logical reasons why Foxboro Instrumentation assures you *optimum* results in measurement or control of process fluid streams. First; Foxboro offers the widest variety of measuring and controlling devices . . . the *right* equipment for every application. For example, only Foxboro offers all these basic meter types: differential pressure cell flow transmitters, magnetic meters, mercury meters, and weir meters. Second; Foxboro provides 45 years of engineering experience in every phase of fluid mechanics. From the simplest general utility-type instrument to complex automatic ratio control systems, you get highest accuracy, efficiency, and economy. Whenever you have a flow problem involving liquids, vapors, gases, or slurries — in pipes, ducts, or channels, you can solve it best by specifying Foxboro. Only a few instruments are described on these pages. For full details; or for specific information on *your* problem, contact your nearby Foxboro Field Engineer, or write **The Foxboro Company, 917 Neponset Ave., Foxboro, Mass.**

FOXBORO

REG. U. S. PAT. OFF.

FIRST IN FLOW

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

Float-and-Cable Type Meters

- Rigid Construction — weather-tight case; all working parts of corrosion-resistant materials
- Powerful Accurate Operation — large, high-stability float; cable of spun glass and nylon—non-stretching, non-twisting
- Direct Reading Chart and Scale
- Direct Reading Integral Counter

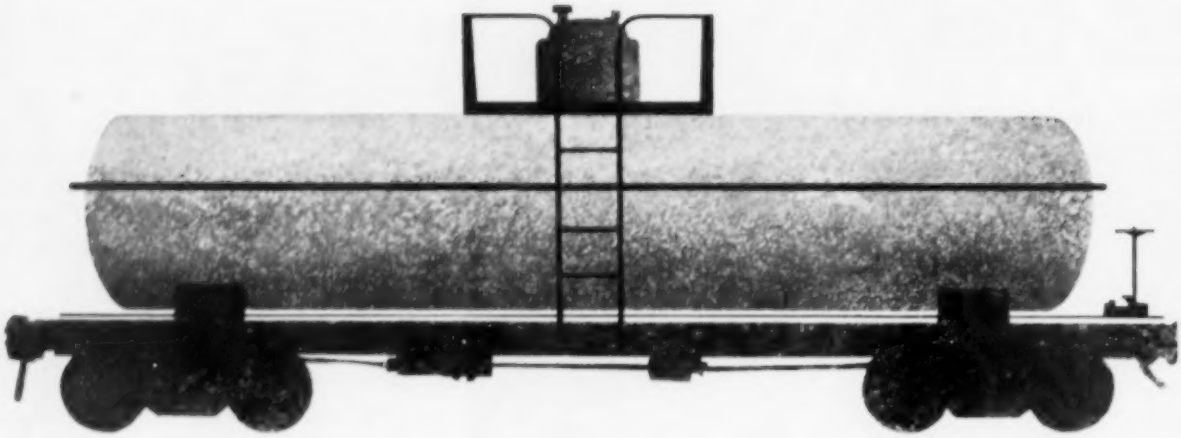
Other Foxboro Flow Instrumentation

Electric or Pneumatic Type Rotameters

Electric, Pneumatic, and Mechanical Integrators

Planimeters

All Primary Elements, Valves, and Accessories required for assembly of complete flow measurement and control systems



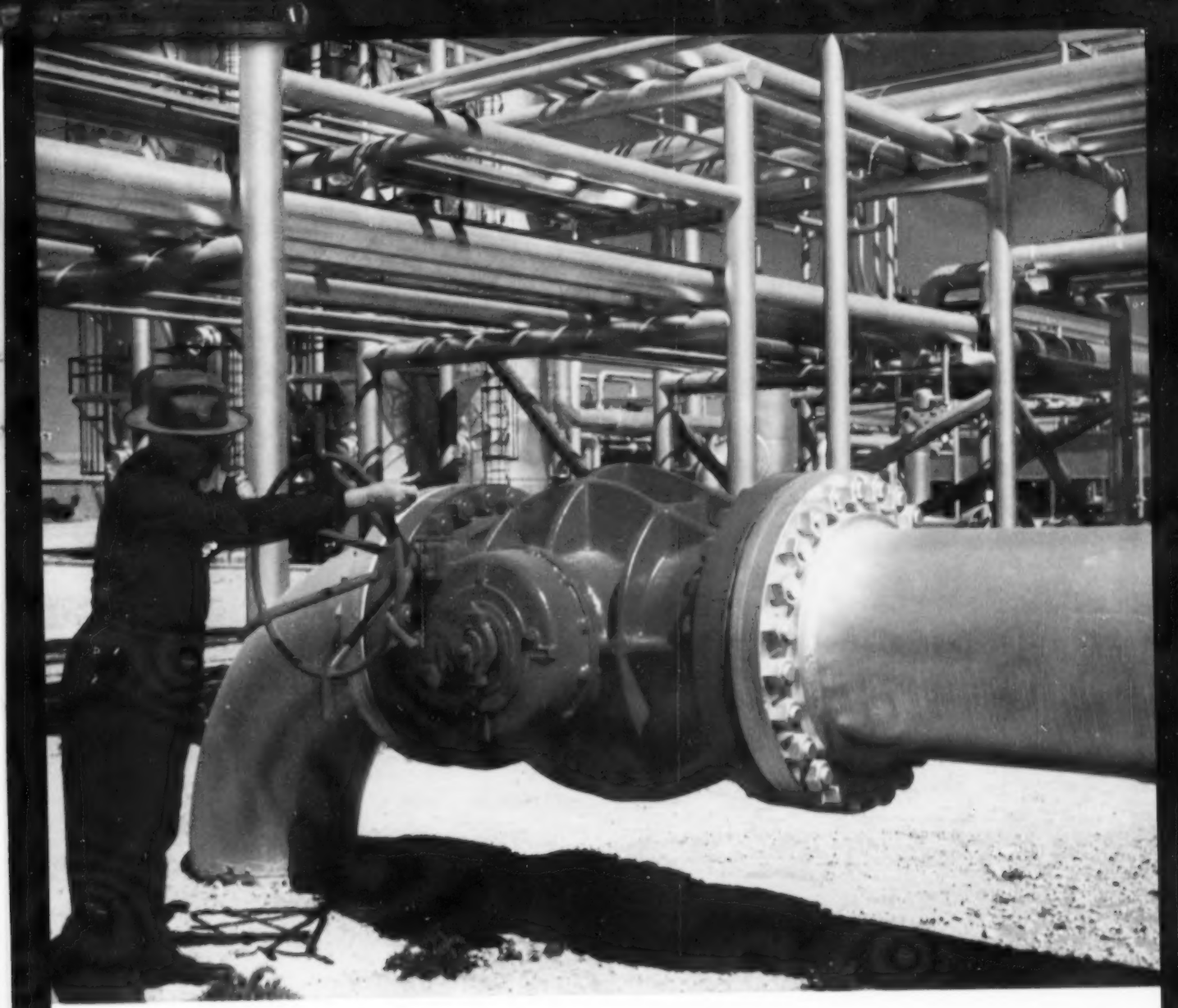
We'll take it...or we'll drink it

Sulfuric Acid sludge is a problem to many...but not to Stauffer!
If you can pour it or pump it or get it in a tank car...
send it to Stauffer. We'll "unsludge" it
and send it back to you...98% pure H_2SO_4.
If you have no sludge and just need Sulfuric Acid,
we have that, too. Available in tank trucks or tank cars
of 6 to 100 tons capacity and barges of
800 to 1500 tons...wherever and whenever you want it
in unlimited supply of all commercial grades.

STAUFFER CHEMICAL COMPANY
380 Madison Avenue, New York 17, N. Y.
Telephone: OXford 7-0600

Stauffer CHEMICALS SINCE 1885

Stauffer means service



How much does a valve cost?

A valve that fails in an emergency can cost millions of dollars in equipment and product loss. In any key spot, Rockwell-Nordstrom lubricated plug valves are your best insurance against this kind of loss. They operate instantly; they shut off positively; and they *stay* efficient. These are facts you can depend on—they have been *proven* through 40 years of outstanding performance.

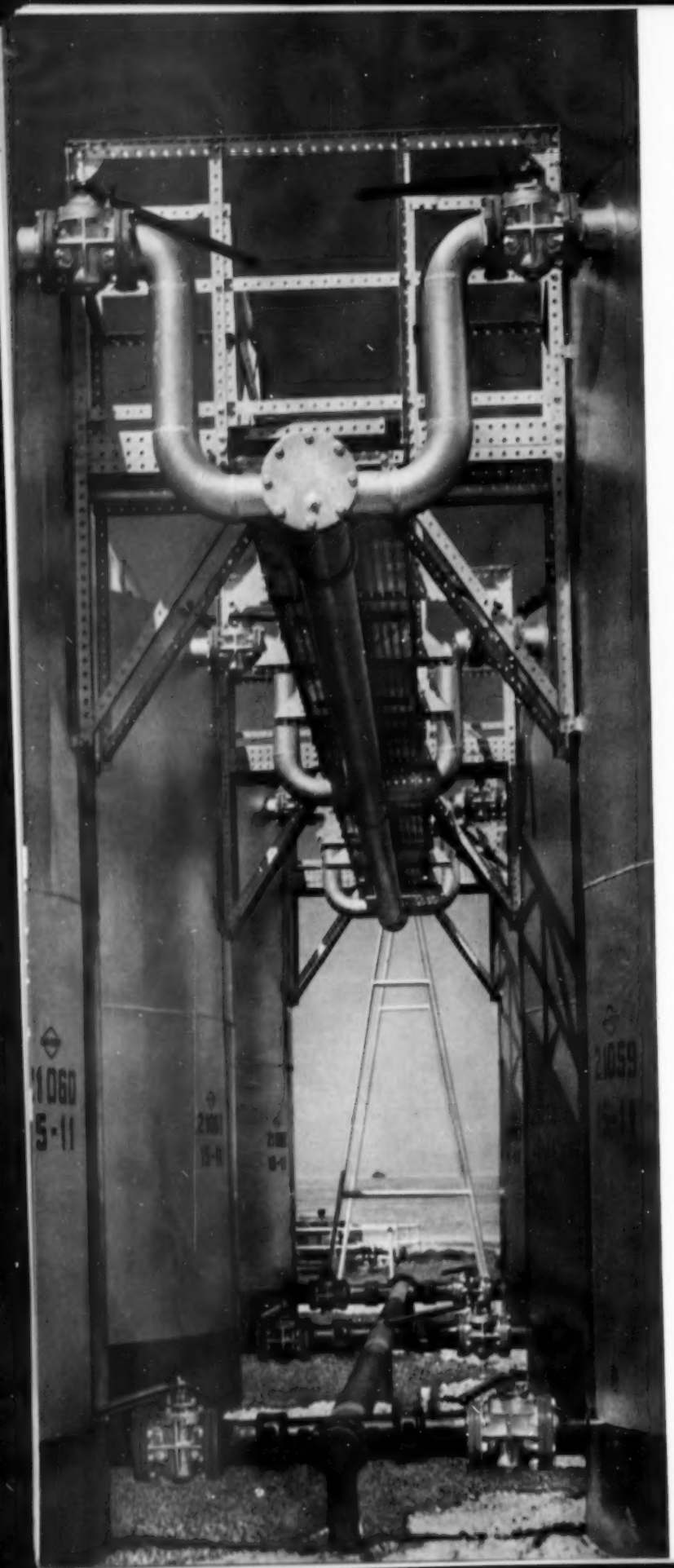
Rockwell-Nordstrom valves are available in a complete range of sizes and pressure ratings. They cost no more to buy, often less, than ordinary valves . . . and their dependability cannot be matched by any valve at any price. For more information, write: Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania.

Available at leading suppliers . . . everywhere

ROCKWELL-Nordstrom **VALVES**

Lubricant Sealed for Positive Shut-off

40th Year *of lubricated plug valve leadership*



Liquid flow control... at its best

Rockwell-Nordstrom valves' proven dependability and economy keep costs down on *any* liquid service. Pressurized lubricant sealing for really positive shut-off, plus smooth quarter-turn operation, assures precise flow control on complex manifolds or remote pipe line valves. Because Rockwell-Nordstrom lubricants eliminate metal-to-metal friction, trouble doesn't have a chance to start. This means that yearly cost is much lower than ordinary valves. Original cost is no more, and often less.

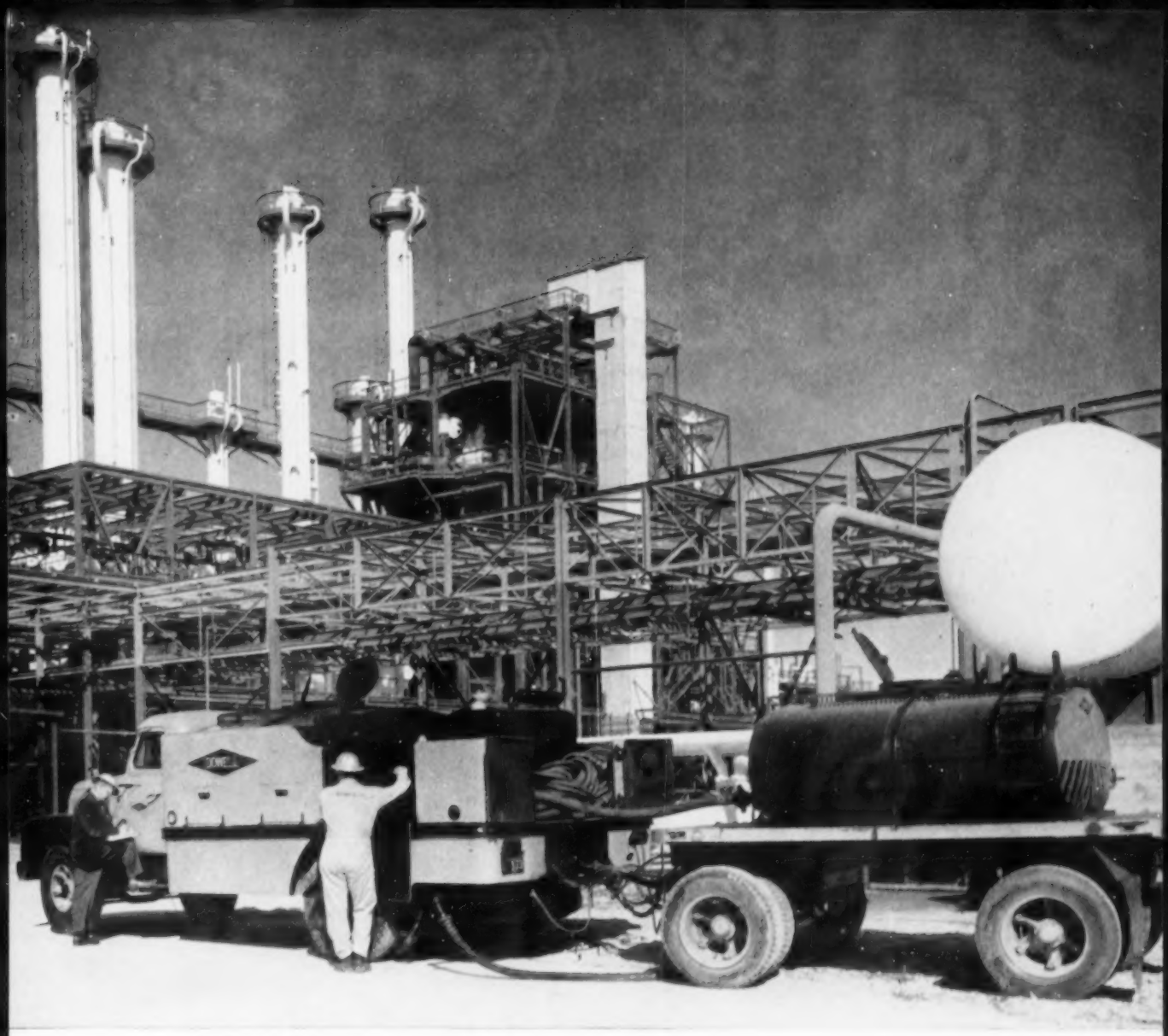
Rockwell-Nordstrom, the original and most complete line of lubricated plug valves, are available in steel, semi-steel, stainless steel and special alloys for a complete range of pressures and temperatures. For more information write: Rockwell Manufacturing Company, Pittsburgh 8, Pennsylvania.

Available at leading suppliers . . . everywhere.

ROCKWELL-
Nordstrom
VALVES

Lubricant Sealed for Positive Shut-off

40th Year
of lubricated plug valve leadership



IT'S NOT WORTH THE CHANCE —CLEAN IT RIGHT

Equipment that operates at less than peak efficiency eats into your company profits. Chemical cleaning can help stop these losses—but only when it's done by experts. Unless you rely on experts, you're taking a chance with your men and valuable equipment.

Dowell engineers understand your cleaning problems and they have the *experience* needed to solve them. Thoroughly trained, they're backed by Dowell's 15 years' experience in removing troublesome scale deposits from virtually every kind of equipment in every kind of industry. They're aided, too, by a completely modern, fully staffed and excellently equipped *research* laboratory.

But, expert cleaning goes beyond keeping your equipment in top condition. Dowell considers the safety of company personnel at every step of the operation. The safest possible working procedures are worked out with your safety personnel.

Call Dowell. Our engineers are always ready to discuss chemical cleaning problems with you. There's no obligation. Or write Dowell Incorporated, Tulsa 1, Okla., Dept. G-32.

chemical cleaning service for industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

Nicholson *steam trap* quality *gives you* . . .

extra stamina for severest service

Write, today, for your copy of new Bulletin 10-55—for detailed information.

Nicholson quality . . . throughout . . . means the extra strength, extra capacity, extra stamina that never let down. And, Nicholson quality pays off, when it comes to discharging condensate and air from petroleum processing steam lines and equipment . . . most efficiently, dependably, economically.

- **powerful valve action—big husky bellows.**
- **positive shut-off—finely ground valve and seat.**
- **high capacity—effective use of large orifice.**
- **each unit service tested—with steam.**

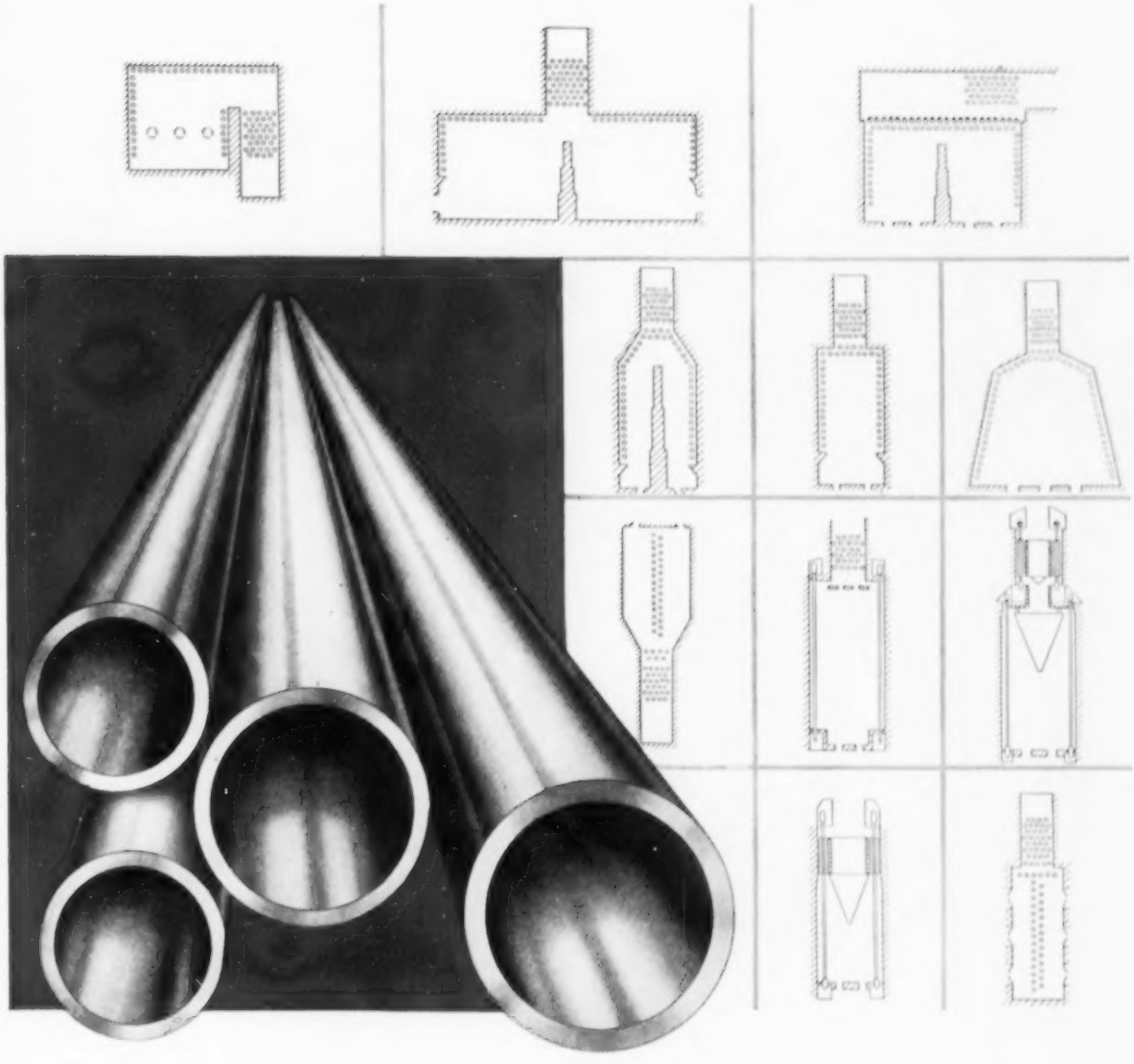
When less than the best won't do, specify Nicholson.

NICHOLSON

W. H. NICHOLSON and Company

TRAPS • VALVES • FLOATS • METAL PARTITIONS
LAUNDRY, DRY CLEANING AND PRESSING MACHINERY

14 OREGON STREET, WILKES-BARRE, PA. • SALES AND ENGINEERING OFFICES IN 98 PRINCIPAL CITIES



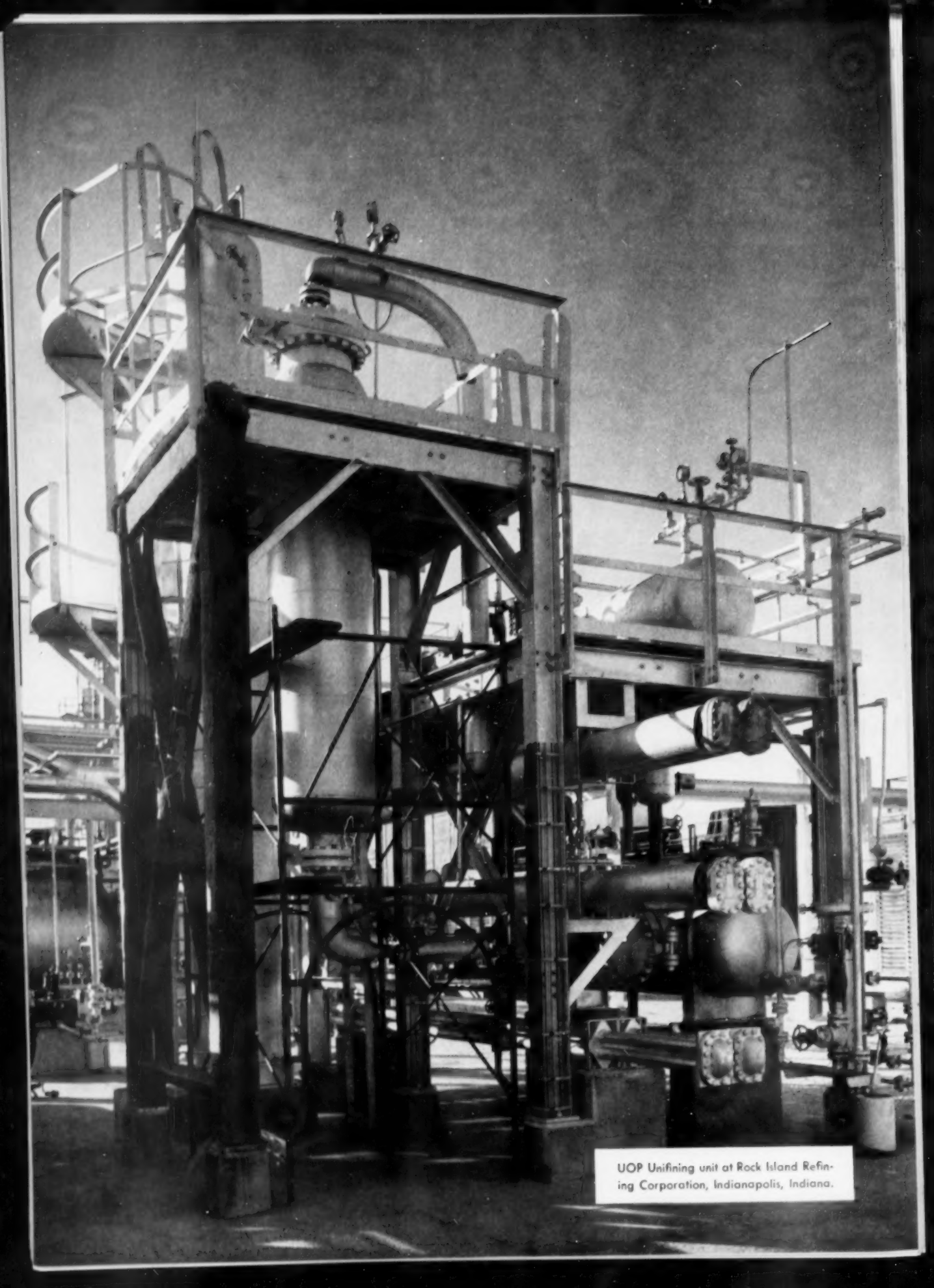
DESIGN ADDITIONAL SERVICE LIFE
INTO YOUR PROCESS HEATERS

. . . with B&W TUBING

Long service life of process heater tubing for the oil refining and petrochemical industries dictates selection of a B&W Croloy to insure maximum corrosion and oxidation resistance, and fully satisfactory handling of unusual temperature and pressure conditions which may arise. Mr. Tubes —your friendly link to B&W—has facts and figures to help you choose the best tube for the job. Get in touch with him to discuss your heater tube requirements, for both original equipment and maintenance. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

TA-6062(P)

Seamless and welded tubular products, seamless welding fittings and flanges—in carbon, alloy and stainless steels



UOP Unifining unit at Rock Island Refining Corporation, Indianapolis, Indiana.

Unifining Solves Major Problem for Rock Island Refining Corporation

By L. E. Winkler
President
Rock Island Refining Corporation
Indianapolis, Indiana

Installation of a 300 barrel per stream day Unifining unit has solved a particularly knotty problem for us, and has enabled Rock Island Refining Corporation to raise the octane rating of its pool gasoline by a full number.

L. E. Winkler

Prior to the time the Unifining unit went on stream last September, our refinery had about 150 barrels a day of low quality vis-breaker gasoline which, if blended with Platformate from our UOP Platforming unit, catalytically cracked gasoline and other refinery stocks, would lower the octane number of the pool gasoline. Using it as a charging stock to the Platformer was uneconomical since the vis-breaker gasoline contained certain contaminants which are known to reduce the life of the catalyst. We were, furthermore, reluctant to make a large capital investment to improve this material, and we did not want to dispose of it as an inferior product.

Universal Oil Products Company designed and engineered the Unifining unit in such a manner that it required only a comparatively small capital investment to convert the vis-breaker gasoline into a choice stock for Platforming. Results obtained so far indicate that the unit will be amortized in about a year on the basis of tetraethyl lead savings.

The Unifining unit at our plant is considerably different from others now in operation. It operates at pressures substantially lower than those normally recommended for processing olefinic stocks; there are no compressors because the low operating pressure made it possible to design the unit to use excess hydrogen from the Platformer without recompression; there are no fired heaters since hot effluent from the Platformer serves to provide a portion of the heat required to maintain the Unifining reaction, and electronic instruments control the unit.

The total make of vis-breaker gasoline is charged to the unit in admixture with enough straight run gasoline to control the heat of reaction. The mixed stream picks up the required amount of hydrogen for the reaction and enters a heat exchanger to be preheated while the reactor effluent is being cooled. The balance of the required preheat is obtained by heat exchange against the reactor effluent from the Platformer. The hot charge flows over the Hydrobon catalyst, which is of the cobalt and molybdenum type, and reactor effluent is heat exchanged against incoming charge and cooled with water before entering a high pressure separator. Any unreacted hydrogen goes to fuel gas. The treated product is further reduced in pressure, then is mixed with the rest of the charge to the Platforming unit.

After Unifining, the total sulfur was reduced to 0.008 weight per cent from an original content of 0.143 per cent. Basic nitrogen has been lowered to less than one part per million when formerly it was 2.7. Arsenic has dropped from 120 parts per billion to less than one part. Only a trace of olefins remains in the product, whereas the charge contained 16 volume per cent. Paraffins have increased from 46 to 58 volume per cent. Naphthenes now are 37 volume per cent against 31 in the charge. Virtually no change is shown in ASTM distillation.

The electronic controls were chosen because we have received good service from similar instruments on the Platformer. This instrumentation was a factor in lining out the Unifining unit when it was placed on stream. Specification product was being produced within four hours after the startup. The controls were comparatively easy to install because of the experience we had on the Platforming unit. They are giving virtually trouble-free service.

Because of Universal's recommendation to install a Unifining unit, we now are converting a normally low quality product which we could not use profitably into a charging stock that is ideally suited for processing in our Platforming unit. Universal furnished the design and process engineering for the Unifining unit, which was built by refinery personnel.

INDIANA REFINER RAISES OCTANE RATING OF POOL GASOLINE BY INSTALLING UNIFINING UNIT

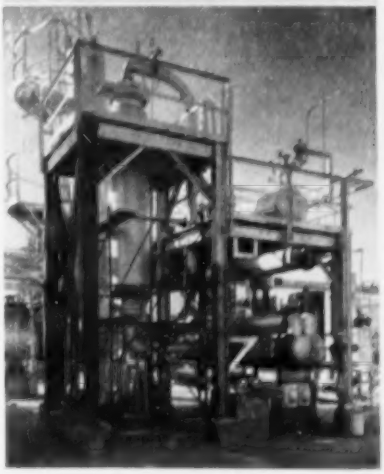
designed, engineered and licensed by

UNIVERSAL OIL PRODUCTS COMPANY

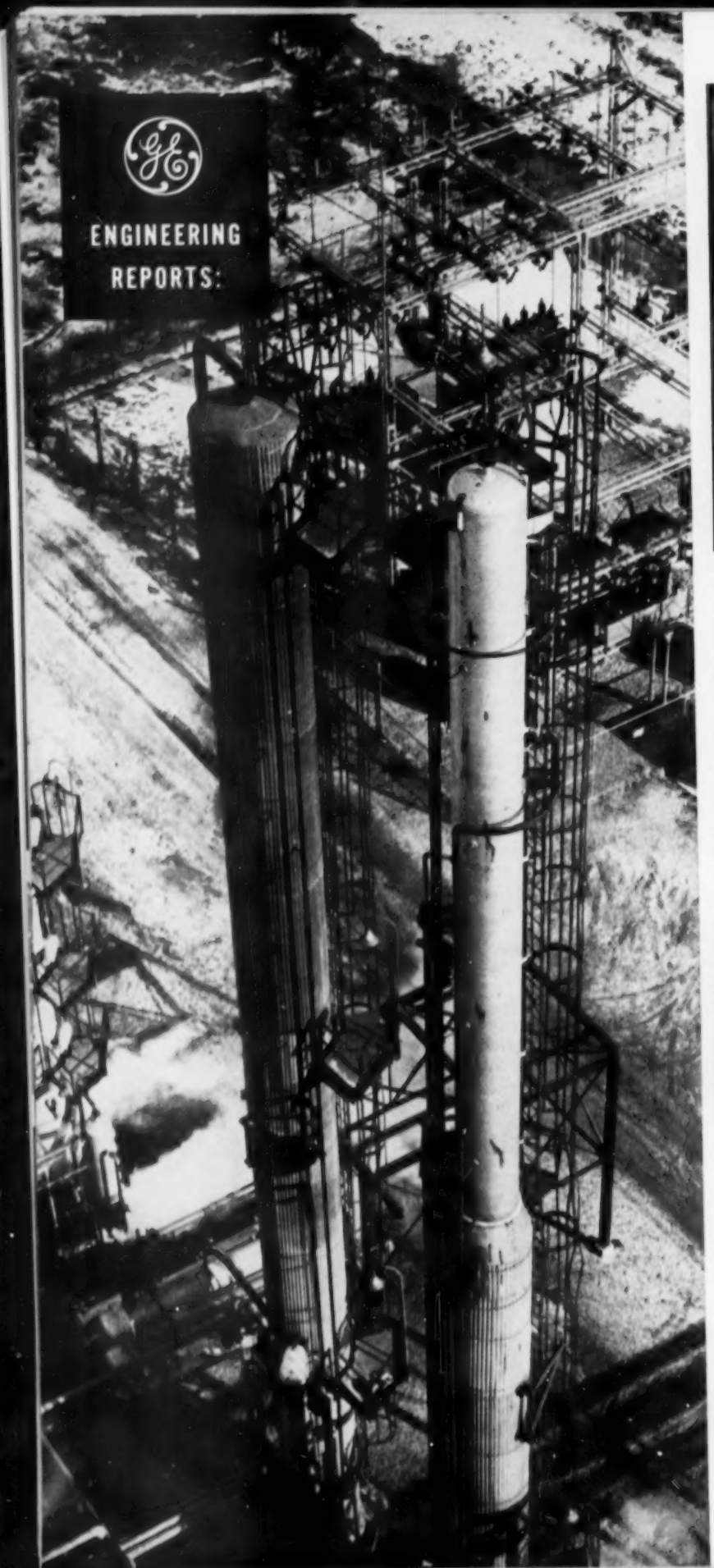
UOP

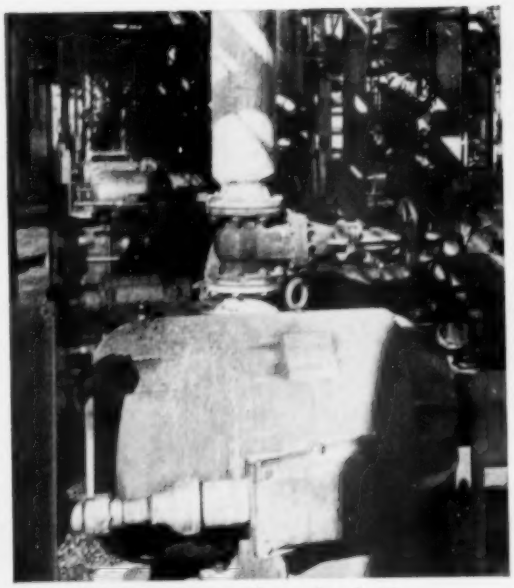
30 ALGONQUIN ROAD,
DES PLAINES, ILL., U.S.A.

Forty Years Of Leadership In Petroleum Refining Technology



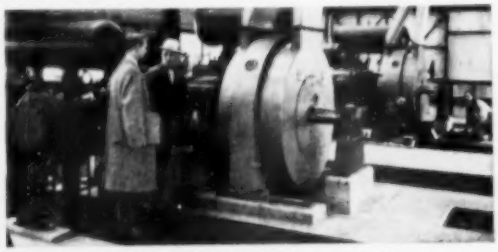
(To obtain more data on advertised products see page 178)





EXPLOSION-PROOF, totally enclosed, 60-hp Tri-Clad* induction motor is one of

RUGGED CONSTRUCTION of G-E explosion-proof, totally enclosed, Tri-Clad motors make them ideal for outdoor refinery applications.



SPECIALLY VENTILATED against process fumes, two G-E 300-hp synchronous motors drive compressors in the new refining unit.

COMPACT AND EASILY INSTALLED, G-E metal-clad switchgear, rated 2400 v, controls synchronous drives for pumps and compressors. *Reg. trade name of the General Electric Co.

14 G-E motors located on the pipeway. Motors require no protective housing.

METAL-CLAD STATION SWITCHGEAR is located outside fenced-in area containing transformers and high-tension circuit breakers; is enclosed against dust and weather.

Bay Refining boosts capacity by 6000 B. P. D. with help of General Electric distribution system

BAY REFINING CORPORATION describes their new catalytic cracking and catalytic polymerization unit, on stream early in 1955, as "Making use of the latest engineering and refinery concepts known to man." The Southwestern Engineering Company of Los Angeles, Engineers and Constructors, was able to complete this modern unit right on schedule—and bring Bay Refining's total capacity to over 10,500 b.p.d. To help meet their schedule, General Electric shipped the electrical equipment according to Southwestern's prearranged timetable, to arrive at the building site when needed.

ELECTRICAL SYSTEMS are fast becoming the standard for refinery prime drive and process control requirements. General Electric offers a complete line of electrical equipment, in a variety of sizes and protective enclosures, to meet refinery needs for greater continuity of service and lower maintenance requirements in a highly corrosive atmosphere.

IN ADDITION, to further help you meet your production requirements, G.E. offers a complete line of engineering services performed by men who know your industry and its electrical problems. They are available to you and your consultants to help design, schedule, supervise installation, and start up an engineered electrical system planned to meet your needs.

- **Project Co-ordination**
- **Application Engineering**
- **Product Development**
- **Analytical Engineering**
- **Installation and Service Engineering**
- **Maintenance Service**

Your G-E Apparatus Sales Representative will tell you more about G-E electrical equipment and Engineering Services for the petroleum industry. Contact him at your nearest Apparatus Sales Office and write for bulletin GED-2244, "Engineering Services," to General Electric Co., Section 681-11, Schenectady, N. Y.

Engineered Electrical Systems for the Petroleum Industry

GENERAL ELECTRIC

Separation of C_4 hydrocarbons calls for furfural. In an extractive distillation, furfural spreads the relative volatilities of closely boiling C_4 fractions and thus provides a means for low cost separation.

Features of the furfural route include:

1. Versatility: Furfural is effective in separating butylenes as well as butadiene, thus a furfural unit can be used to prepare alkylate stock and butadiene. The process employs petroleum type equipment which can be adjusted to a variety of operating conditions.

2. Purity: Highest purity butadiene is produced and has been the consistent rule since commercial operations began.

3. Safety: QO Furfural is easy to handle and has a safety record extending over 30 years of industrial use.

4. Corrosion: There is no appreciable corrosion in furfural units, thus minimizing maintenance problems.

The furfural route offers you a 13 year record of successful performance in 3 plants, having maximum capacities in excess of 346,000 tons of butadiene per year. Two new units using furfural are now being built.

• • •

Write for information on furfural extractive distillation and Bulletin 203-A listing physical properties of furfural.

The Quaker Oats Company
CHEMICALS QO CHEMICALS DEPARTMENT

339C The Merchandise Mart,
Chicago 54, Illinois

ROOM 539C, 120 Wall St.,
New York 5, N. Y.

Room 439C, Main P. O. Box 4376,
Portland 8, Oregon

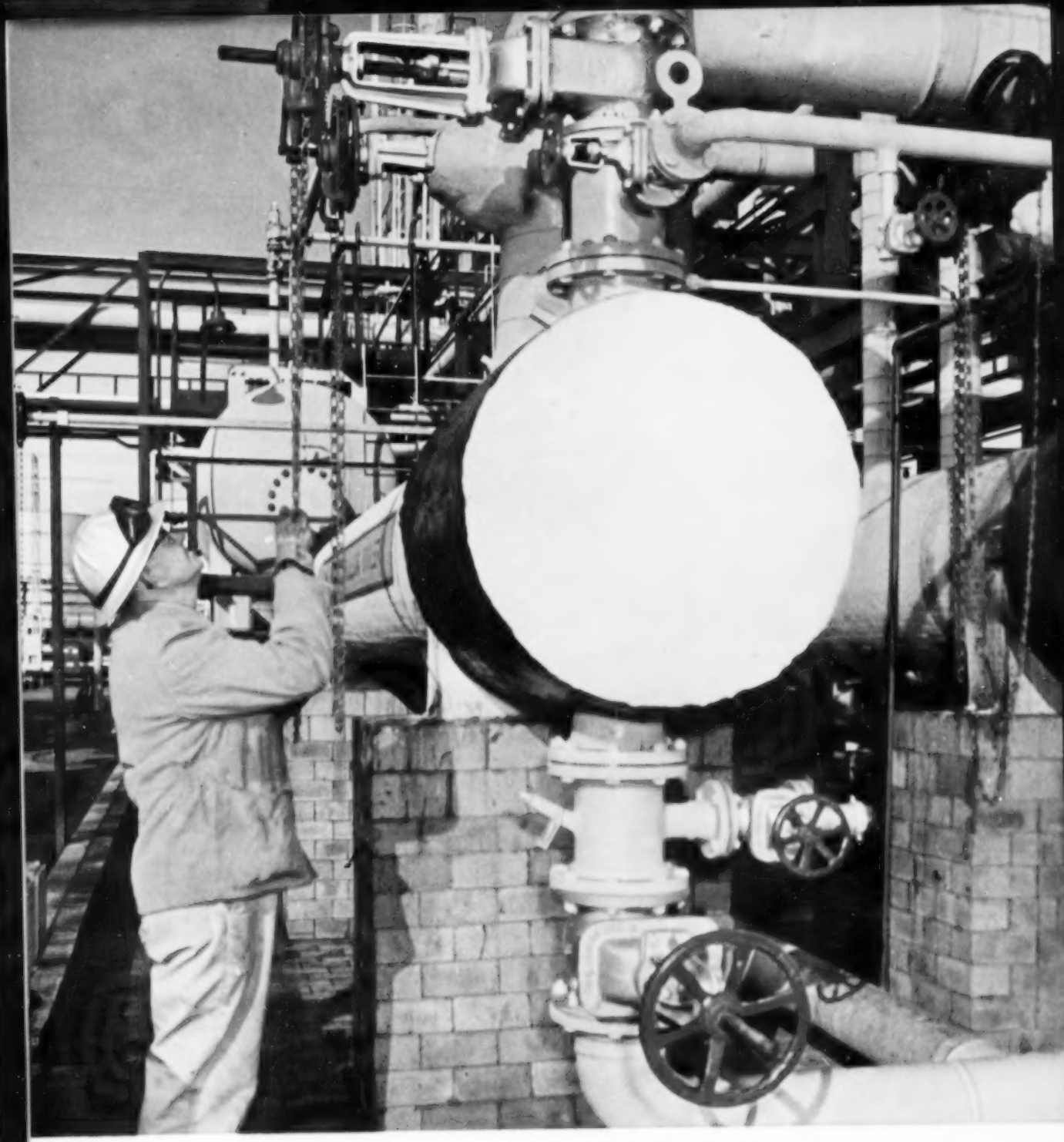
In the United Kingdom:
Imperial Chemical Industries Ltd., Billingham, England

In Europe:
Quaker Oats-Graanproducten N. V., Rotterdam, The Netherlands;
Quaker Oats (France) S. A., 3, Rue Pillet-Will, Paris IX, France;
A/S "Ota", Copenhagen, S. Denmark

In Australia:
Swift & Company, Pty., Ltd., Sydney

In Japan:
F. Kanematsu & Company, Ltd., Tokyo

(To obtain more data on advertised products see page 178)



Closing the gate on hard-to-hold hydrocarbons

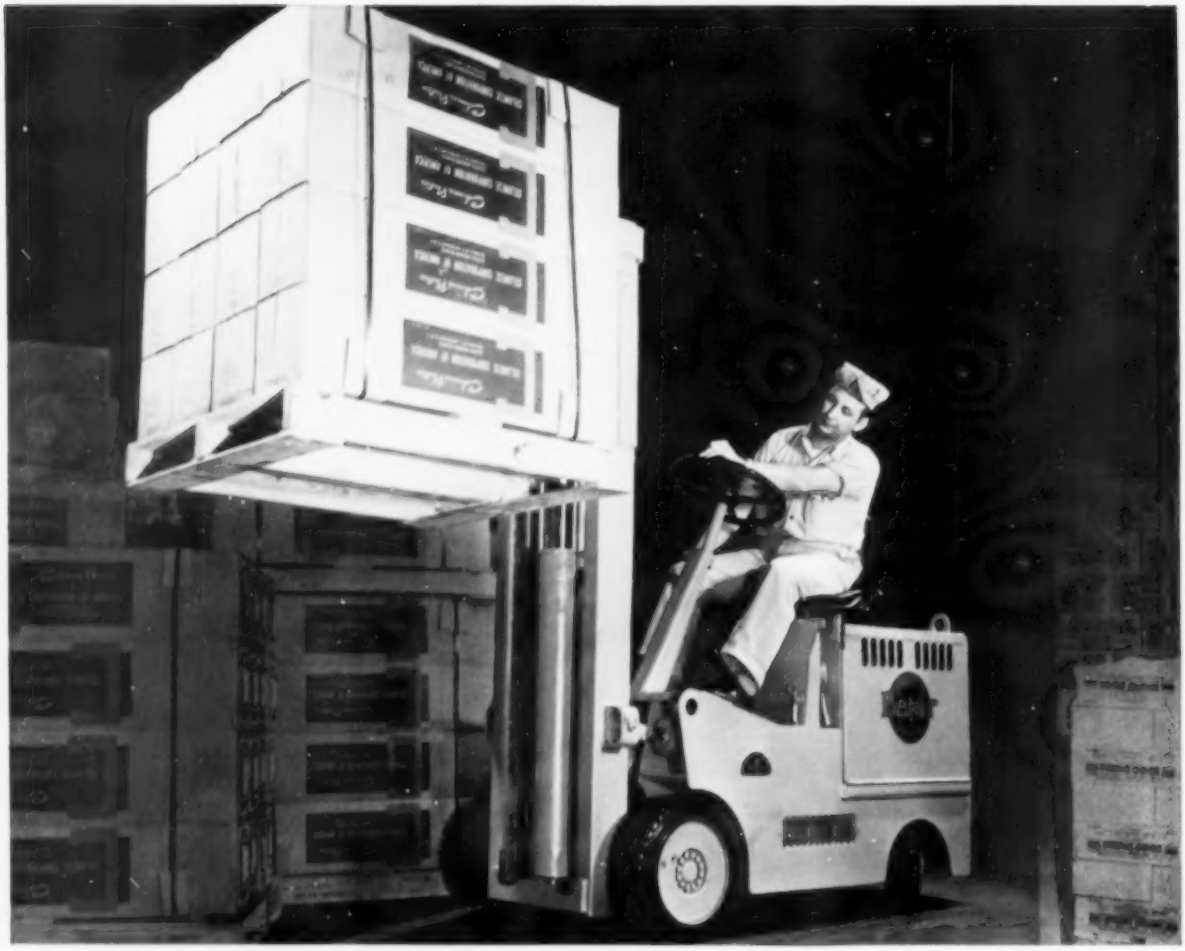
At Esso Standard Oil's Bayway Refinery light hydrocarbons are used extensively at a wide range of temperatures and pressures.

Light hydrocarbons are hard to "hold," but the self-adjusting wedge design on Aloyco gate valves insures tight shut-off. Corrosion-resistant Aloyco valves — like the red-wheeled, chain-operated gate valve above — are used throughout many process units.

You'll see many more of them on key jobs at leading petroleum, processing and chemical plants throughout the country. What about your corrosives-handling problems? Write Alloy Steel Products Company, Inc., 1901 West Elizabeth Avenue, Linden, New Jersey.

62

Subsidiary of Walworth Company



Maneuverable BAKER "FT" Electric Trucks have lower silhouette, greater stability!

• Ability to maneuver safely and quickly in narrow aisles and tight places with large, heavy loads means more and faster work from new Baker "FT" electric trucks. Contributing factors are less overhang, lighter weight, lower silhouette, greater stability, shorter turning radius and greater forward tilt.

These new trucks have many other features for safe, more efficient operation. More convenient controls – right where operator wants them – are easy and simple to actuate. Absence of cowl and other obstructions means better visibility, greater ease in mounting and dismounting from either side. Dynamic braking means greater safety on ramps, smoother stops, more protection for truck and load. Self-energizing, self-equalizing hydraulic foot brakes and separate parking brake linked to driver's seat give added safety.

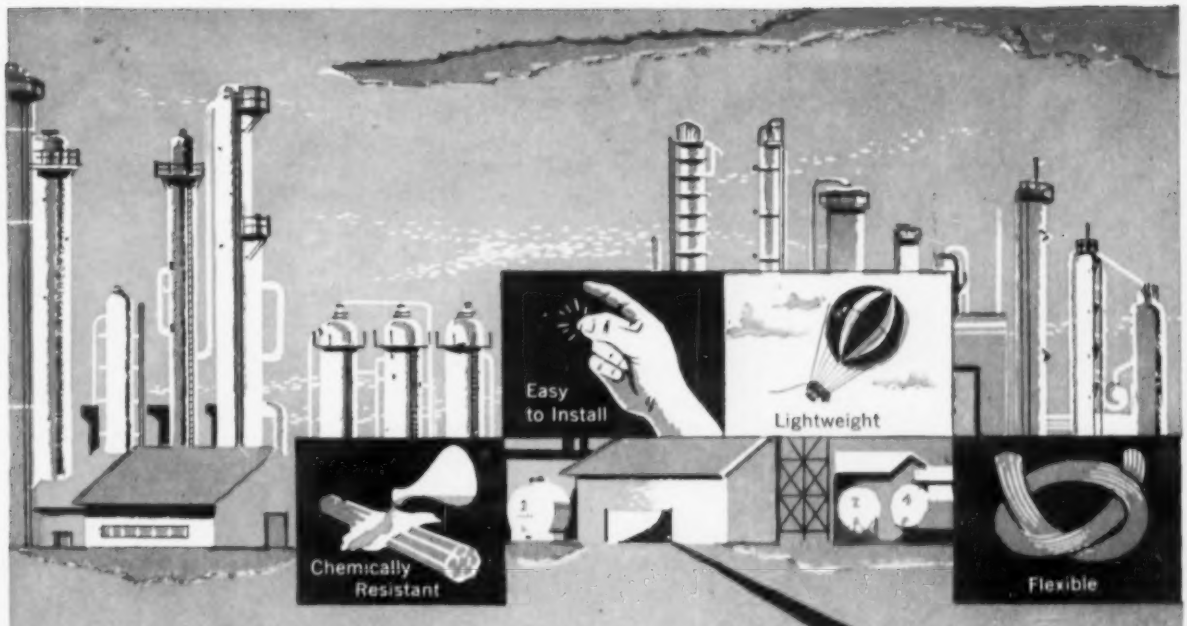
Capacities to 6000 pounds. Write for specific bulletins.

Baker®
handling equipment

THE BAKER-RAULANG COMPANY
1248 WEST 80th STREET • CLEVELAND 2, OHIO

A subsidiary of Otis Elevator Company

6E-4



DEKORON

Poly-Cor

harness

Now you can whip high instrument tubing installation and replacement costs in your plant—with Dekoron Poly-Cor®. That's because the chemical resistance of plastic even outlasts expensive alloy tubing . . . because its lighter weight and flexibility make it a snap to install without special tools . . . because you can install practically any number of tubes at one handling, just like electric wiring. You can't lose with Dekoron Poly-Cor — it cuts your investment because of its lower installed cost, cuts your maintenance because it lasts years longer.

Tube up with DEKORON completely

Dekoron products now include single and multiple line metal tubing with plastic coating, multiple tube all-plastic instrument line harness (above), flat 10-tube "ribbon," fittings and junction boxes.

Dekoron products

QUALITY • RESEARCH • SERVICE

SAMUEL MOORE & COMPANY

DEKORON PRODUCTS DIVISION • MANTUA, OHIO

This clad steel can do anything solid high alloy can do!

...and think of the difference in cost!

Clad steel demonstration unit featured at the Nat'l Assoc. of Corrosion Engineers show.

COMPARE THE VALUE!

■ Throughout the petroleum industry, clad steel has proved its value as a modern construction material for tanks and pressure vessels.

Clad steel gives you the protection of solid high alloy—at a down-to-earth cost! In fractionating towers and desulphurizers, as in so many other applications, clad steel is saving money for hundreds of users by adding to equipment life, simplifying maintenance, providing valuable flexibility that permits repeated changes in equipment to suit changing needs.

Lukens is headquarters for clad steels of all kinds. A selection of 16 cladding and 11 backing metals gives you practically unlimited combinations to meet virtually any conceivable need!

For more information, consult your equipment builders or write Manager, Marketing Service, Lukens Steel Company, 841 Lukens Building, Coatesville, Pennsylvania. Outline your interests and we'll show you in detail just why we say *clad steel is the ideal material for long range economy.*

SEE FOR YOURSELF!

ECONOMY – high-alloy layer assures corrosion resistance, long equipment life.

STRUCTURAL STABILITY – low-cost backing steel provides strength and rigidity.

DESIGN FREEDOM – integral bond allows design and fabrication of shapes to meet process and space needs.

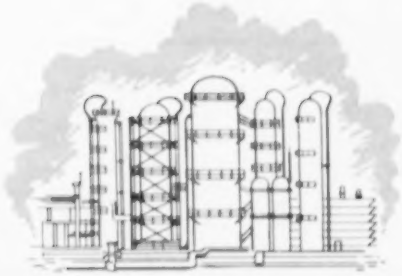
LUKENS CLAD STEELS

LUKENS

STAINLESS-CLAD • NICKEL-CLAD • INCONEL-CLAD • MONEL-CLAD

Producers of the Widest Range of Types and Sizes of Clad Steel Plates and Heads Available Anywhere

TRECo TRECo TRECo TRECo TRECo TRECo



DESIGN
ENGINEERING
CONSTRUCTION

A DIVISION OF VITRO CORPORATION OF AMERICA

The REFINERY ENGINEERING Company

NEW YORK TULSA TORONTO

Hard faced to resist seat wear

WITH STELLITE

...at no extra cost!

GP Globe Valve-Series 800

Stubborn resistance to valve seat wear, due to erosion, corrosion and galling, is built into Vogt GP valves with Stellite faced seating surfaces used in conjunction with hardened discs and wedges. By an exclusive method, hard facing alloys are welded to the integral seat of globe and angle valve bodies and to the removable stainless steel seat rings of gate valves.

This important feature, available at no extra cost, assures operation economies and longer valve life. A catalog describing the complete General Purpose line of valves in sizes 1/4" to 2" will be sent on request.

Adv. No. 3 in a series describing the features of Vogt GP valves.

Write For Your FREE COPY of Supplement No. 1 to Catalog F-9. Address Dept. 24-FPP.

HENRY VOGT MACHINE CO.
P. O. Box 1918 • Louisville 1, Kentucky

SALES OFFICES:
New York, Philadelphia, Cleveland, Chicago, St. Louis, Charleston, W. Va., Cincinnati, Dallas, San Francisco

Vogt

GENERAL PURPOSE GP

Vogt FOR BETTER VALVES

DROP FORGED STEEL

VALVES

AEROLUBE® 93-C

ZINC DITHIOPHOSPHATE

Fights Wear... cuts engine repair

Test-engine valve lifter above was protected by oil containing AEROLUBE 93-C Zinc Dithiophosphate. Badly worn valve lifter below received ordinary lubrication.

Nine out of ten new cars today are delivered with zinc dithiophosphate in the initial fill or "break-in" oil.

The reason? Major automotive manufacturers have found zinc dithiophosphate the most effective wear inhibitor, particularly in the valve train mechanisms of modern V-8 high-compression engines.

Best of the zinc dithiophosphates is Cyanamid's AEROLUBE 93-C, specially modified to give superior antiwear characteristics. It also controls oil oxidation and checks formation of oil-insoluble sludges and varnishes. It retards formation of peroxides and organic acids that corrode cadmium-silver and copper-lead bearings.

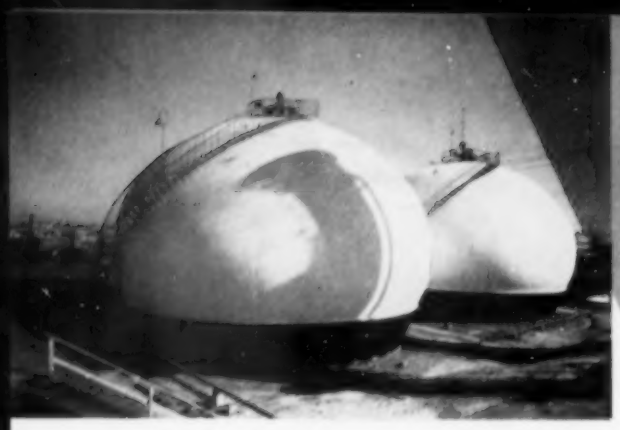
Very light in color, compatible with all lube oil stocks and other additives, AEROLUBE 93-C may be used alone for API Service MM and initial fill requirements, or with detergents such as AEROLUBE 90 for heavy-duty formulations.

Whether you are formulating lube oil for initial fill or day-to-day service, try AEROLUBE 93-C Zinc Dithiophosphate for better control of wear, oil oxidation and bearing corrosion.

CYANAMID

AMERICAN CYANAMID COMPANY
REFINERY CHEMICALS DEPARTMENT
30 Rockefeller Plaza, New York 20, N.Y.

In Canada: North American Cyanamid Limited, Toronto and Montreal



Left: Hortonspheroids, pressure containers for the storage of volatile liquids. No evaporation can occur as long as internal pressure does not exceed pressure relief valve settings.

Right: Storage tank equipped with Hortondome Roof. Temporary storage for vapor is provided by flexible membrane in the dome.

Vapor Conservation is not a problem . . . *with Proper Storage Equipment!*

Every time a fixed roof tank storing volatile liquid vents, someone's profit disappears. Chicago Bridge & Iron Company can help control these losses . . . with their:

Horton® Floating Roofs	Hortonspheroids®
Hortondome® Roofs	Vaporspheres®
Hortonspheres®	Vaportanks*

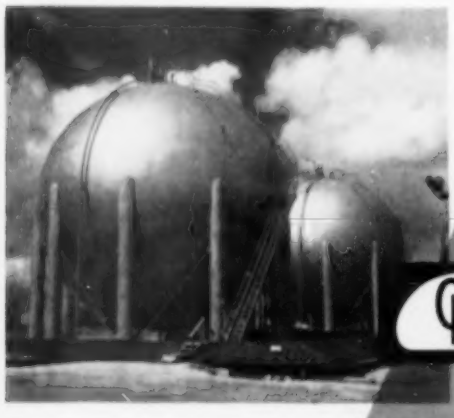
CB&I is a steel plate specialist . . . with the experience and facilities to design, fabricate and erect welded steel plate structures to the exacting requirements necessary for the storage of volatile hydrocarbons. When you plan vapor conservation equipment, write our nearest office for information, estimates or quotations.

**Trade Mark.*

Above: Horton Vaportank or Vaporsphere, connected to the vapor spaces of fixed-roof tanks, provides temporary storage for displaced vapor beneath a flexible membrane.

Above: Tanks equipped with Horton Floating Roofs. Bottom of the roof is normally in contact with the liquid in the tank leaving no space for an air-vapor mixture to form.

Below: Hortonspheres are designed to store the more volatile liquids, such as butane. Vapor cannot escape as long as the internal pressure does not exceed the settings of the pressure relief valves.



CB&I

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
Los Angeles • New York • Philadelphia • Pittsburgh • Salt Lake City
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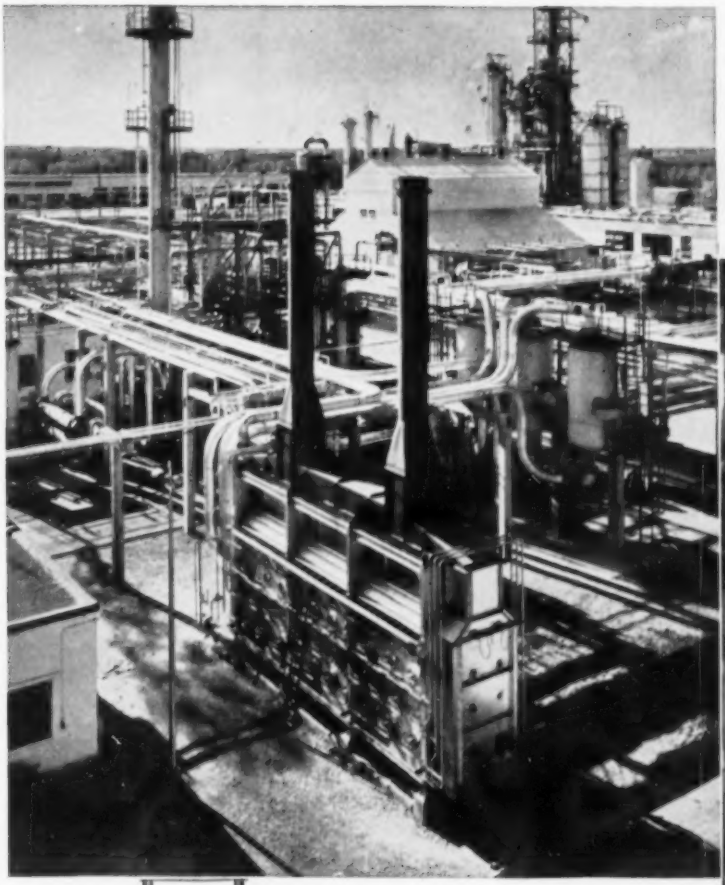
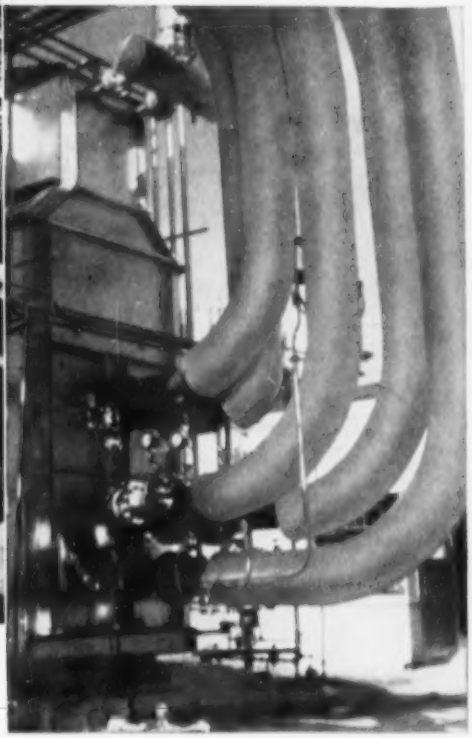
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.

REPRESENTATIVES AND LICENSEES:
Brazil • Canada • England • France • Italy • Netherlands • Scotland • Venezuela



Split-Second Response... ±1°F Control In Catalytic Reforming at Imperial Oil Ltd.



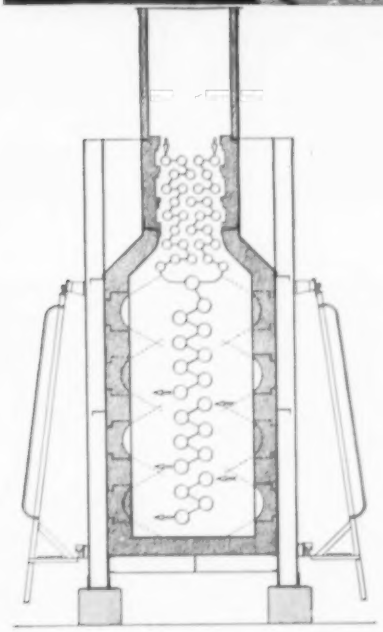


Diagram illustrates the flow of material through the multiple coils during preheat, first and second reheat cycles.

...with Selas Gradiation® Heating

Instantaneous response to changes in operating conditions with a temperature variation of only ±1°F . . . is the most important contribution of this Selas furnace installation at Imperial Oil, Ltd., Edmonton. Add Zone Control, which permits independent heating of multiple coils in a single radiant chamber; longer tube life because of non-oxidizing furnace atmospheres and you will understand the trend to Selas Gradiation Heating.

Send for Bulletin 97 "Gradiation Heating for Petroleum and Chemical Processing."

SELAS
CORPORATION OF AMERICA
DRESHER, PENNSYLVANIA

Heat and Fluid Processing Engineers
DEVELOPMENT · DESIGN · CONSTRUCTION

You pick the place... we'll put the plant on it.

IN fact, McKee's fifty years of experience in designing and building plants for major industries can be a valuable help to you in selecting the site.

And McKee can undertake the entire project from preliminary studies to completed plant, ready for initial operation, under a *single contract.*

You'll find physical evidence of the excellence of McKee engineering and construction in successfully operating plants all over the world. If you want your new plant designed and built to earn a profit *call in McKee.*

McKee
ENGINEERING & CONSTRUCTION Services

Arthur G. McKee & Company • Engineers and Contractors

Headquarters: McKee Building • 2300 Chester Avenue • Cleveland 1, Ohio
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Canada: Arthur G. McKee & Company of Canada, Ltd., 372 Bay St., Toronto

PETROLEUM CHEMICALS DIVISION

NEWS

July ★ One of a Series of Bulletins for the Petroleum Industry ★ 1956

Question Box

1. HOW can you persuade your dealers to try for increased sales volume on the basis of good management practices?

   The article at the right may give you some ideas.

2. HOW can you insure stability of distillate fuel oils?

   See below for answer and other important information concerning effective additives.

3. WHO can help you with your fuel oil stability problems?

   You can read on the next page about one of many Du Pont specialists in this field.

Need continues for additives in all types of fuel oils

The market for fuel oils is becoming more complex as the result of a demand for petroleum products tailored to specific consumer needs.

To accomplish this tailoring job, chemical additives generally offer you the easiest and most economical means . . . particularly where stability and blending compatibility problems are involved. This is true of furnace oils, diesel fuels, and residual fuels.

The various aspects of tailoring these different types of fuel oils to consumer demands through the use of additives were recently discussed in a paper by William deB. Bertolette and John D. Rogers of the Du Pont Petroleum Laboratory, presented before the Western Petroleum Refiners' Association.

Du Pont Fuel Oil Additive No. 2 (FOA-2) is ideally suited for stabilizing these fuel oils because it is an *ashless* polymeric additive. This means that it does not leave a metallic deposit or alter the chemical characteristics of the deposits that are formed.

Stabilizer and dispersant

Du Pont FOA-2 not only stabilizes the fuel to prevent sludge formation, but it also helps to rid dirty systems of any sludge that may have previously formed.

If you would like more information on Du Pont FOA-2 or a copy of the W.P.R.A. paper entitled "Improving Fuel Oils through the Use of Additives," just send your request to any of our sales offices listed on the next page.

Why are some dealers more successful than others?

The latest report — No. 5 in the Du Pont Service Station Operator Survey — reveals many controllable factors bearing on this question.

"Stay open long hours . . . advertise . . . carry a complete line of tires, batteries and accessories!"

These three practices are common to *most* of the stations which are *most* successful. There are, however, many more ingredients of success revealed in Du Pont's Service Station Operator Survey, Report No. 5, just published.

Marketing men in the industry of course are well aware of the factors which make a service station successful.

However, the highly interesting statistics developed through the survey may help them determine the degree to which each factor contributes to success, and may go far toward helping them convince dealers.

Most significant

This is the final and most significant report of the 5-part series. It discusses the *interrelationship* of various factors affecting service station operation. It may also interest you to know that in preparing this report, the results were sorted, weighed and correlated by the Univac electronic computer.

The survey data, however, should not be interpreted to show cause-and-effect relationships. And no single one of the factors analyzed, of and by itself, can guarantee success. Too, some of the variables may be considered beyond the station operator's control.

Successful stations

Yet, the report shows clearly that there is a marked difference between successful and unsuccessful stations. What's more, most of the variables considered in this report are of such a nature that

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

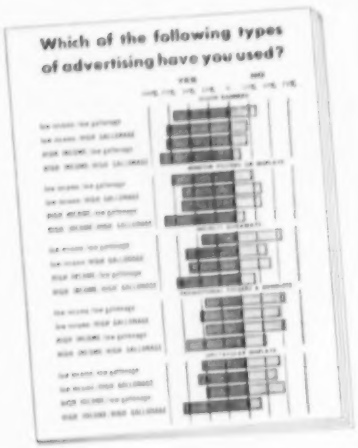
PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED *Dealer Success*

the service station operator has, within his power, the means for reducing any differences between his station and stations that are outstandingly more successful.

In practical terms, this means that of any representative cross-sectional group of stations, some can usually be said to be enjoying a higher income than the average if an established set of conditions is met:

1. Stay open longer.
2. Do more advertising.
3. Offer complete services.
4. Managed by operator with long experience in charge of station.
5. Managed by operator active in community projects and organizations.
6. Owner-operated.
7. Are neat.
8. Managed by better educated operator.
9. Sell TBA.
10. Price of regular gasoline thought by dealer to be lower than in his vicinity.



HERE IS a typical page from Report No. 5 on the Du Pont Service Station Operator Survey. It shows that over 40% of the high-income/high-gallonage stations spend more than $200 annually for off-station advertising. On the other hand, only 6.8% of the low-income/low-gallonage stations spend more than $200 annually for off-station advertising.

Continued middle next column

AT DU PONT PETROLEUM LABORATORY

WILLIAM deB. BERTOLETTE is Technical Service Supervisor of the Fuel Oil Group at the Du Pont Petroleum Laboratory.

He joined the Du Pont Company in 1936 after graduating from Pennsylvania State University with a B.S. degree in chemical engineering. His first assignment was at the company's Jackson Laboratory, where he did analytical work on dyes and other organic chemicals. He was then transferred to the Chambers Works where he became a chemist in the TEL area.

From 1938 to 1946, Mr. Bertolette was stationed at the Baton Rouge plant. There he was in charge of chemical control work, and later became a TEL Production Supervisor. He was transferred to production control work in Wilmington in 1946. In 1950 he joined the Technical Section.

He assumed his present position at the Petroleum Laboratory in 1955. Mr. Bertolette is a member of the American Institute of Chemical Engineers and of the Petroleum Division of the American Chemical Society.

WILLIAM deB. BERTOLETTE

Relative importance studied

Although no absolute dollar values can be assigned to the success-factors, we were able, with the help of the Univac, to analyze their importance relative to the over-all success of a number of stations in the survey sample. You will probably find the bar charts presenting these data among the most interesting and valuable parts of this Survey Report No. 5.

The report also discusses each of the factors individually . . . with the supporting evidence clearly presented in the easy-to-follow bar chart form.

Survey entirely objective

Sponsored by Du Pont, the survey was conducted on a completely impartial basis by National Analysts, Inc. It was nationwide in scope and a part of the continuing market research work conducted by the Du Pont Petroleum Chemicals Division. It follows logically the recent Du Pont survey of service station customer buying habits.

Using the scientifically accurate area sampling method, the survey consisted of personal interviews with 2,633 service station operators. This sample is representative of all the operators in the United States.

Available to marketers

The findings of this report, like the findings of the four which preceded it, are available to all oil companies.

For more information about this survey, just get in touch with one of our representatives at the nearest sales office listed below.

DU PONT
Better Things for Better Living
. . . through Chemistry

Petroleum Chemicals

E. I. DU PONT DE NEMOURS & COMPANY (INC.) *Petroleum Chemicals Division* • *Wilmington 98, Delaware*

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ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-2266

Printed in U. S. A.

Just change the pins for new process conditions.

Beckman "Pinboard" Data System Speeds Pilot Runs—Gets You On-Stream Faster!

A pilot plant isn't operated to make money; its purpose is to speed process development and plant design. With more of the right kind of information from a pilot plant, trial runs are completed faster, and the full-scale process is profitably on stream sooner.

The Beckman "111" Data System shortens pilot plant time because:

- exclusive pinboard programmer obsoletes all calibration and "knob-twiddling".
- all operations are digitally controlled.
- system is set-up with pinboard in a matter of seconds, eliminating time-consuming changes formerly required to meet new process conditions.
- results are presented in true physical units, such as pounds per square inch or degrees Fahrenheit, to a wide variety of read-out equipment.

To learn why leading companies are choosing the Beckman "111", write Beckman Instruments, Inc., Data and Control Systems Department, Fullerton, California. Ask for Data File D-1-23.

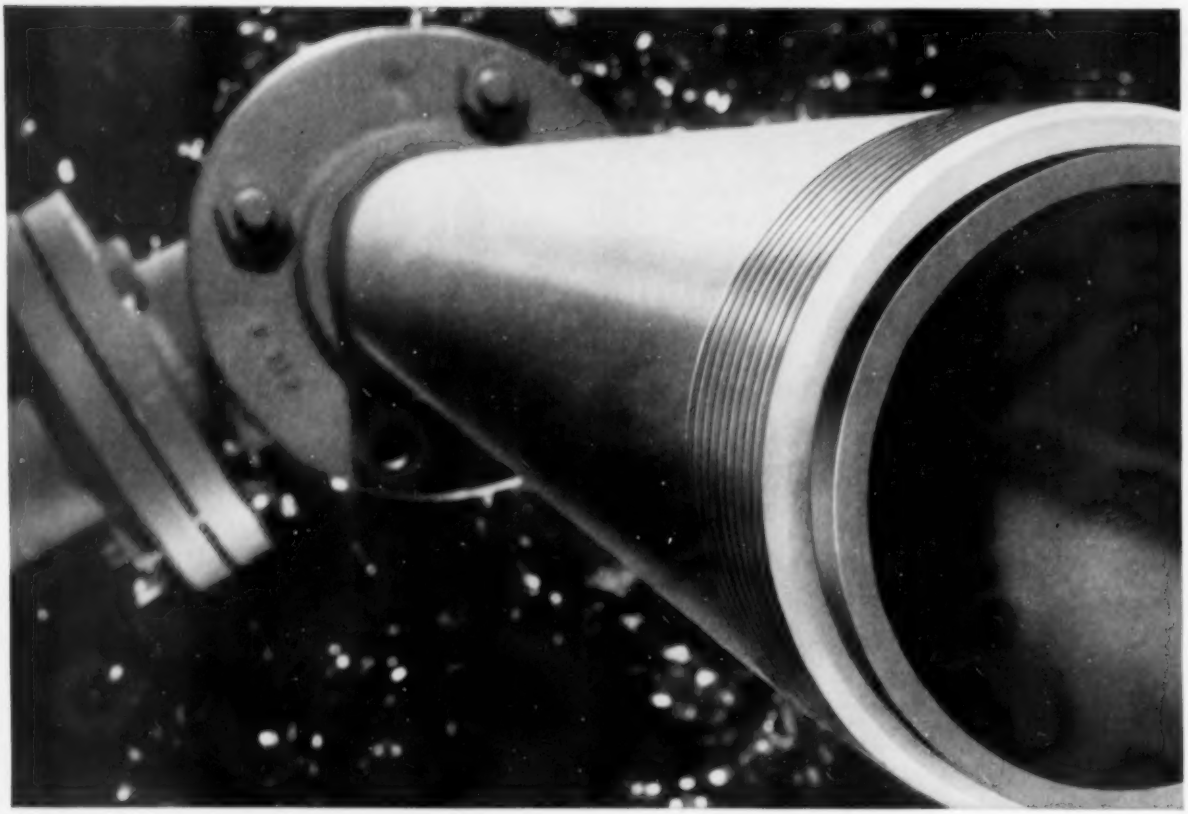
The Beckman Data System provides the link between plant instrumentation and tabulated data for use by your engineering and computer center.

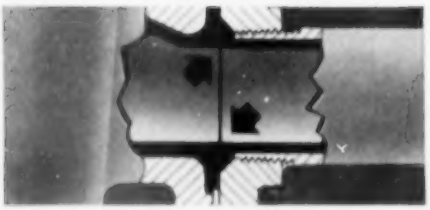
Beckman / *"111" Data System*

Our continued growth creates openings for additional creative engineers. Write for Career File #10.

(To obtain more data on advertised products see page 178)

DOW





Saran lined pipe to saran valves. Notice the saran lining is continuous.

You can see why Saran Lined Pipe eliminates costly downtime

Corrosive liquids can't touch the strong steel pipe . . . even at fittings . . . it's lined continuously with thick, durable saran

Saran lined pipe, fittings and valves convey acids, alkalies and many other corrosive liquids for years with trouble-free performance. One chemical manufacturer reports a saran lined pipe installation used intermittently for ten years with no corrosion shutdowns. Similar reports came from the petroleum waste, pulp and paper, metal finishing and food processing industries.

Saran lined pipe is made of corrosion-resistant saran swaged into rigid steel pipe. Saran lined pipe, fittings and valves form snug, tight-fitting, leak-proof joints . . . is available for working pressures up to 150 psi. Valves and fittings are also available in steel for working pressures to 300 psi. This modern piping is easily installed, too. It can be cut and threaded in the field with available pipe fitters' tools. Its rigidity means few supporting structures are needed. For further information on saran lined pipe, fittings and valves, send in the coupon on the left. THE DOW CHEMICAL COMPANY, Midland, Michigan.

Saran Lined Pipe Company
2415 Burdette Avenue
Ferndale, Michigan
Dept. SP6289

Please send me information on saran lined pipe, fittings and valves.

Name _____ Title _____

Company _____

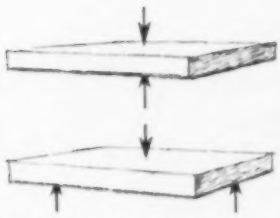
Address _____

City _____ State _____

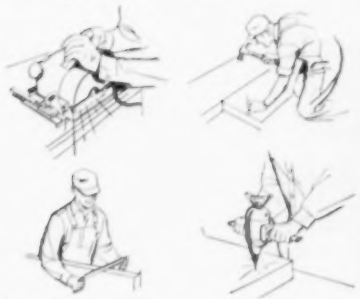
Saran Lined Pipe is Manufactured by The Dow Chemical Company, Midland, Michigan

you can depend on DOW PLASTICS

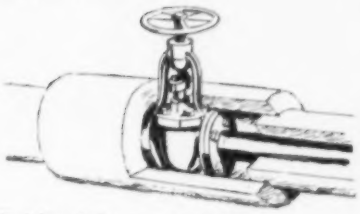
DOW



Unequaled compressive and flexural strength!



Saw it . . . nail it . . . shave it . . . drill it!



Bridge joints and fittings without fear of breakage!

KAYLO® and FIBERGLAS*

INDUSTRIAL INSULATIONS

. . . distributed by approved Fiberglas distributor-contractors . . . offer the most versatile family of plant insulations available. With new *pink* Kaylo-*20* (increasing the upper range of Kaylo by 600° F.!), you can now order—from *one* reliable supplier—complete insulation coverage *from lowest sub-zero to 1800° F.*, serving such extra-high temperature applications as catalytic cracking units, refractory wall backing for furnaces and boilers, and fireproofing of piping, equipment, and vessel skirts. See *Sweet's Files, Chemical Engineering Catalog*, or *Refinery Catalog*. Or write Owens-Corning Fiberglas Corporation, Dept. 185-G, Toledo 1, Ohio.

OWENS-CORNING FIBERGLAS

*T.M. (Reg. U.S. Pat. Off.) Owens-Corning Fiberglas Corporation
® T.M. Reg. Owens-Illinois Glass Co., Inc., mfr. of Kaylo

Specify KAYLO®

Heat Insulation

for strength and lightness!

(To obtain more data on advertised products see page 178)

TWO GREAT NAMES

Teamed For Quality...Service...Progress

Two steelmakers, each known for its achievements in its own particular field of producing forged and annular rolled products are now combined to supply requirements of the largest and smallest. Two groups of production and research engineers are joined to better serve American industry. The new company is a totally owned subsidiary of Heppenstall and will operate independently. Each company will continue to offer American industry the custom made products for which it is famous.

MIDVALE - HEPPENSTALL CO.

NICETOWN
PHILADELPHIA 40, PA.

A SUBSIDIARY OF HEPPENSTALL COMPANY

Brown Fintube

Thermo-Flo

TANK HEATERS

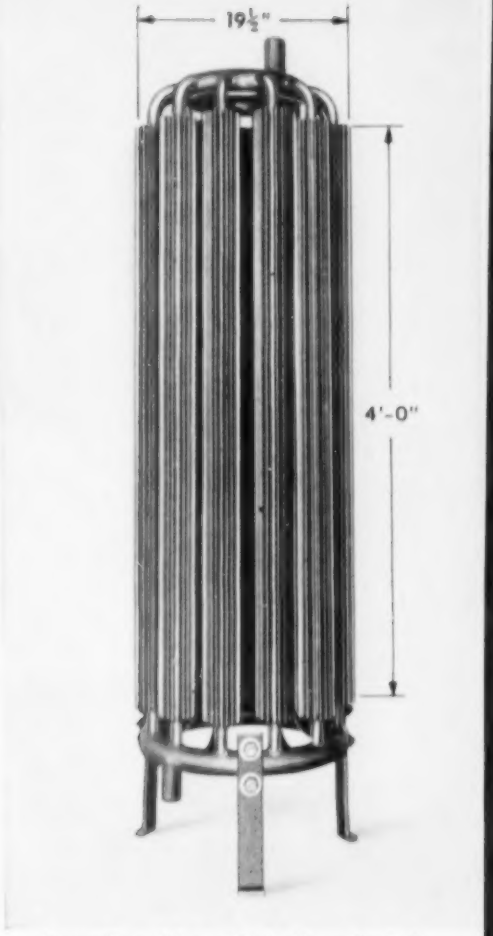
Vertical mounting keeps the bottom of the tank uncluttered; prevents sediment from settling on the heating surface; permits the heater to be entirely immersed in the product; and avoids the loss in efficiency of trying to heat from a coil insulated in sediment on the tank bottom.

The large surface area of the finned tubes permits more heat to be transferred at lower "skin" temperature. Product adjacent to the heater rises rapidly forming a thermal siphon in the tank, that assures efficient heating; prevents overheating; avoids stratification; and keeps the heating surface clean.

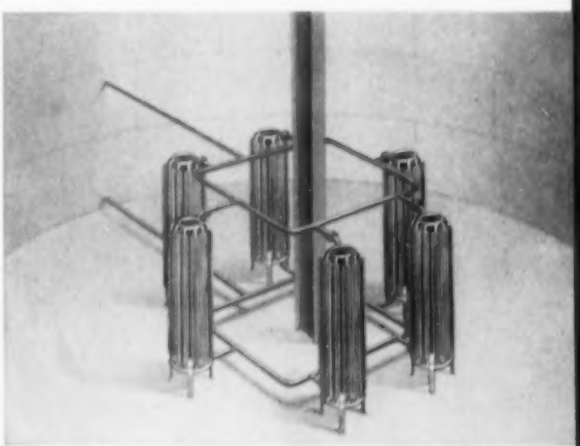
Mild steel, stainless or special metal construction. Can be stress relieved if desired. Easily installed in new tanks or tanks already in service. Used — and highly endorsed — by practically all large well-known companies maintaining tank farms.

Bulletin No. 561 gives full details.

WRITE FOR A COPY TODAY!



Above, View of Brown Fintube Thermo-Flo Tank Heater Showing the Legs that are Adjustable to Overcome any Unevenness of the Tank Bottom.



Six Thermo-Flo Tank Heaters Manifolded to a Single Steam Line in a Bunker C Storage Tank, **Showing Bottom of the Tank Completely Open for Quick, Easy Cleaning.**

BROWN FINTUBE COMPANY

Elyria, Ohio

Engineering and Sales Representatives in the Principal Cities

power

83.6

This Powerforming unit, designed and constructed by Foster Wheeler for Esso's Baltimore refinery, charges approximately 3,000 barrels per day of heavy virgin naphtha which has been desulfurized in a Hydrofining unit whose operation is integrated with that of the Powerformer.

FOSTER

NEW YORK • LONDON

forming

percent, 98* clear

*Research Octane of Debutanized Reformate

- **New, more active platinum catalyst**
- **Special regenerative technique maintains optimum catalyst activity**
- **Lower pressure operation – 200 to 300 psig**
- **Higher yields of high octane reformate**

This combination provides the refiner with a most effective means for the catalytic reforming of low-octane naphthas into high-octane motor fuel components.

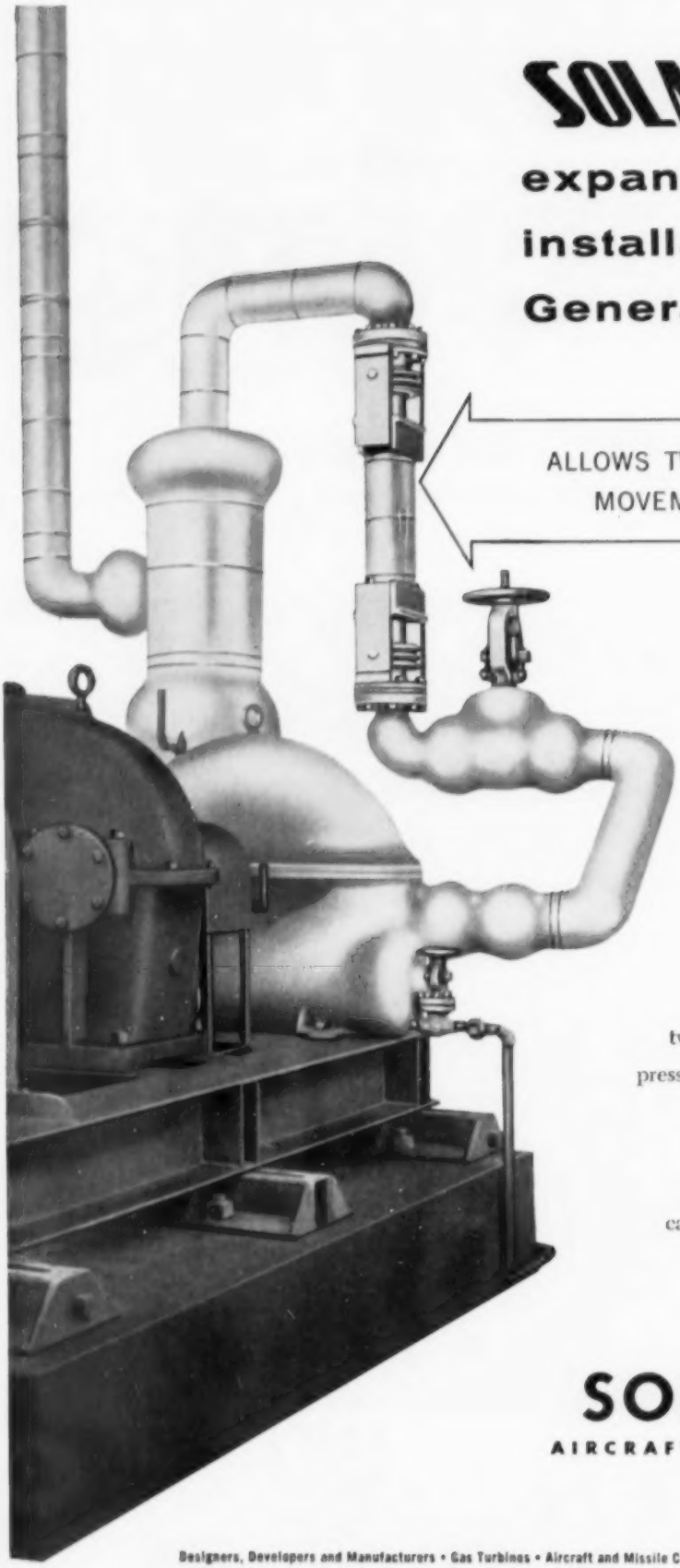
Powerforming, developed by Esso Research and Engineering, has already proved its outstanding performance on three units which are now in successful operation. Fourteen more are under construction or in the design and planning stage.

The first Powerforming unit, shown at the left, in operation since May 1955 was designed and constructed by Foster Wheeler for Esso's Baltimore refinery. FW is currently providing mechanical design and construction for two more Powerforming units – a 20,000 barrel per day unit at the Bayway refinery and a 7,000 barrel per day unit at Imperial's Halifax refinery where Foster Wheeler is also building Crude Distillation, Fluid Catalytic Cracking, Polymerization and Treating units. For further information write to *Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.*

WHEELER

PARIS • ST. CATHARINES, ONT.

(To obtain more data on advertised products see page 178)



SOLA-FLEX®

expansion joint installation for General Petroleum

ALLOWS TWELVE INCH LATERAL MOVEMENT OF TURBINE

PROVIDING FLEXIBILITY for the steam connection to this turbine assembly was a problem at General Petroleum. The turbine had to be movable to permit installation and take up of drive belts to the compressor unit. A practical solution was found in the use of a 3 in. offset Sola-Flex hinged joint, 42 in. long. The bellows allows a 6 in. movement in two directions—and stands up under rugged pressure and temperature conditions. No matter what kind of expansion joints you need, Solar can build them—ruggedly and economically. Ask for the latest Sola-Flex catalog. Dept. C-33, Solar Aircraft Company, San Diego 12, California.

SOLAR AIRCRAFT COMPANY

SAN DIEGO
DES MOINES

Designers, Developers and Manufacturers • Gas Turbines • Aircraft and Missile Components • Bellows • Controls • Coatings • Metal Alloy Products

(To obtain more data on advertised products see page 178)

NEWS ITEM . . .

Gulf Coast refinery engulfed by capacity demands of kerosene cooler

Solved by

RETUBING with WOLVERINE TRUFIN* TYPE S/T

From a first class bottleneck to a unit producing 80% more than original capacity is the story of a kerosene cooler in the process line of a Gulf Coast refinery.

The cooler, a plain tube unit, was unable to keep up with the refinery's constantly increasing production demands. There were two ways in which refinery engineers could handle the situation:

(1) A new and larger unit could be designed and built.

(2) The existing unit could be retubed with Wolverine Trufin Type S/T—the integral finned condenser tube.

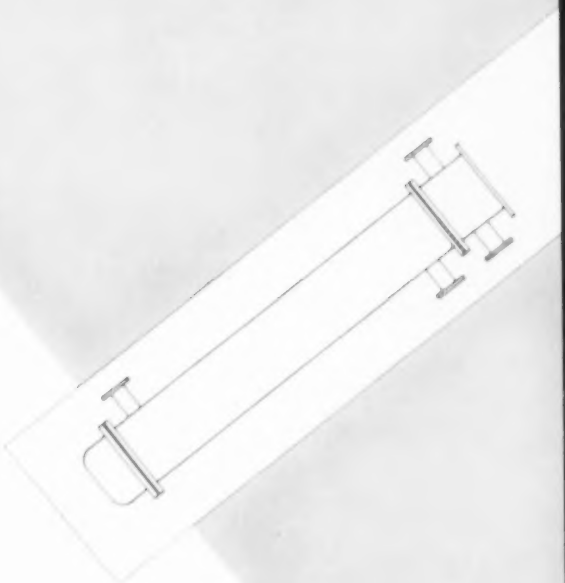
After careful consideration it was decided to retube with Wolverine Trufin. The results were immediate and highly satisfactory. Production on the cooler could be increased by a full 80%—and the bottleneck was a thing of the past. In addition the refinery realized substantial savings in time plus the elimination of the costs of designing and building a new unit.

The reason for Trufin's ability to boost heat transfer performance is found in its integral fins—extruded directly from the tube wall. Because of this, Trufin S/T has approximately twice the heat transfer surface of plain tube—extracts more BTU's per foot of tube.

Trufin Type S/T is completely interchangeable with prime surface tube using standard tools and retubing techniques.

If your plant has similar bottlenecks, Wolverine Trufin Type S/T condenser tube can help you solve them. Next time you retube, specify Trufin—watch production go up and costs stay down. Wolverine's new Process Flowsheet Catalog is filled with process drawings of actual Trufin installations. Write for your copy today.

WOLVERINE TUBE, 1441 Central Avenue, Detroit 9, Michigan.



Wolverine Trufin available in Canada through the Unifin Tube Company, London, Ontario

DIVISIONS OF CALUMET & HECLA, INC.
CALUMET DIVISION
WOLVERINE TUBE DIVISION
CANADA VULCANIZER & EQUIPMENT CO., LTD.
FOREST INDUSTRIES DIVISION
GOODMAN LUMBER CO.

WOLVERINE TUBE

Division of Calumet & Hecla, Inc.

*REG. U. S. PAT. OFF.

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.

EXPORT DEPARTMENT, 11 EAST 60TH STREET, NEW YORK 19, NEW YORK

WOLVERINE FIELD ENGINEERS

answer questions about

TRUFIN* TYPE S/T

condenser tube

Frequently, Wolverine Field engineers are asked this question:

In what type of application is Wolverine Trufin* Type S/T most advantageous and to what extent?

Their answer: **Trufin offers most advantages when used for change of phase services such as condensation and vaporization.**

CONDENSATION: The rate of condensation is closely related to the thickness of the condensate film which collects on the tubes; the thicker the film—the lower the rate. The action of Trufin, cutting through the condensate film, restricts the thickness to which the film can build up. The result is an appreciable gain over the condensing rate obtainable with the same number of square feet of prime surface tube.

VAPORIZATION: For such units as reboilers and evaporators, Trufin offers tremendous advantages although the reason and mechanism naturally differ from fluid-to-fluid heat transfer. The convection is much more vigorous and the vaporization transfer rate is higher because a square foot of Trufin surface occupies much less volume than a square foot of plain tube surface.

Furthermore, the upper edges of the fins preferentially serve for bubble nucleation; thus, the bulk of the surface is less susceptible to vapor binding than plain tube surface and heat flux limitations are not decreased by the reduced volume of the exchanger.

The advantages of Wolverine Trufin Type S/T over plain surface tube can vary from a small percentage to gains of 100% on a lineal foot basis depending on the type of application. For ideal conditions such as those that exist in some hydrocarbon condensers and reboilers, the increase in effectiveness can actually be greater than the outside area ratio of Trufin over plain tube.

Similar information along with valuable design data is contained in Wolverine's Trufin Opportunity Book. Write for your copy today.

WOLVERINE TUBE, 1441 Central Avenue, Detroit 9, Michigan.

*REG. U. S. PAT. OFF.

DIVISIONS OF
CALUMET & HECLA, INC.

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& EQUIPMENT CO., LTD.
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WOLVERINE TUBE

Division of Calumet & Hecla, Inc.

Manufacturers of Quality Continuous Tubing and Extruded Aluminum Shapes

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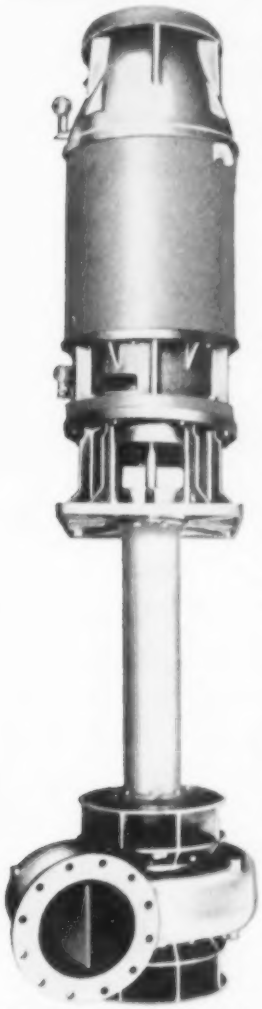
Bingham

TYPE "VS" DOUBLE SUCTION DOUBLE VOLUTE VERTICAL PUMP

REDUCES COSTS WITH SHALLOW PIT LOWER MAINTENANCE



SPECIALLY DESIGNED FOR WET-PIT SERVICES. COOLING TOWER, SPRAY POND, DISPOSAL SUMP, WATER SUPPLY, DRAINAGE — AND OTHER HIGH-CAPACITY, MEDIUM-HEAD WET-PIT SERVICES.

The Bingham "VS" Pump saves money in 3 ways: (1) Lower installed cost because it does not require a deep pit and can use standard motors. (2) Lower operating cost, because it operates at higher efficiencies, uses less power. (3) Lower maintenance cost, because there is no stuffing-box, all bearing loads are light, and the installation is easy to inspect and service.

The "VS" Pump will deliver the same capacity at the required head as conventional multi-stage Deep-Well Turbine Pumps, but with the space saving benefits and higher operating efficiencies resulting from the advanced design of a "Double Volute - Double Suction" single stage pumping element.

The "Double Volute" construction of the "VS" Pump, maintains radial balance of its rotating element throughout the entire operating range of the pump. Wear due to *"Side Push"* is eliminated.

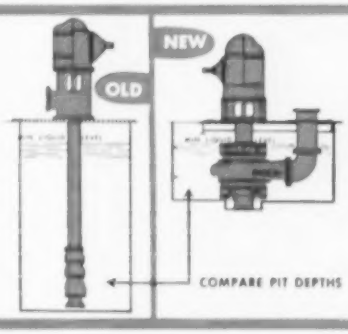
These and many other important reasons make the Bingham "VS" Pump the most logical choice today for wet-pit service. For full details, call your nearest Bingham office, or write for Bulletin 110.

A Battery of Bingham "VS" Pumps Operating at a major Gulf Coast gas processing plant.

COMPARE THESE PITS FOR COST

OLD

Conventional Deep-Well Turbine Pump Installation . . . requires the pit be deep enough to maintain sufficient pumpage above the pumping elements in order to provide the required NPSH.



NEW

Bingham "VS" Pump Installation . . . requires only a shallow pit and only sufficient pumpage to cover the pumping elements. Pit construction is thereby greatly reduced.

Bingham SINCE 1921

DOUBLE VOLUTE PUMPS RADIAL BALANCE

BINGHAM PUMP COMPANY

General Offices: **2800 N.W. Front Avenue, Portland 10, Oregon**

Factories: **Portland, Ore. • Vancouver, B. C., Canada**

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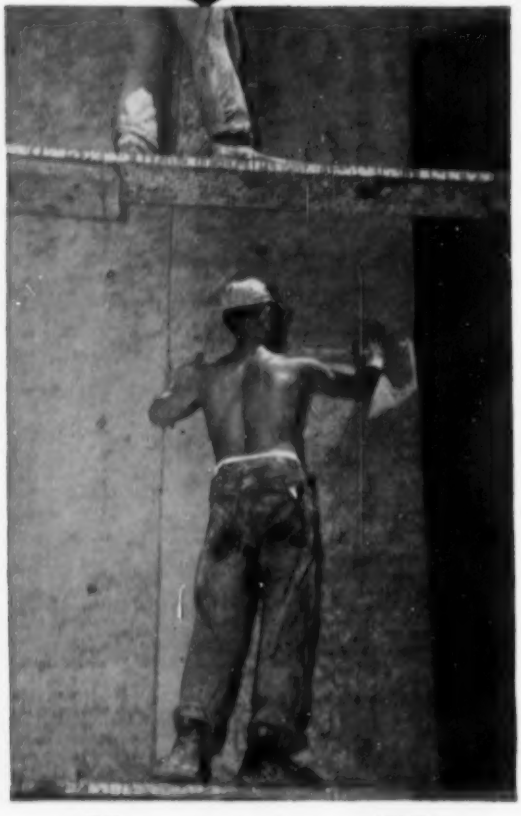
SEATTLE, WASH.
ST. LOUIS, MO.
ST. PAUL, MINN.
TULSA, OKLA.
TORONTO, ONT., CAN.
VANCOUVER, B. C., CAN.

(To obtain more data on advertised products see page 178)

VERSATILE

ULTRALITE

TANK INSULATION



Techniques of applying Ultralite vary, but everyone agrees that it is by far the fastest and cheapest way to insulate tanks, vats, vessels and other heated equipment.

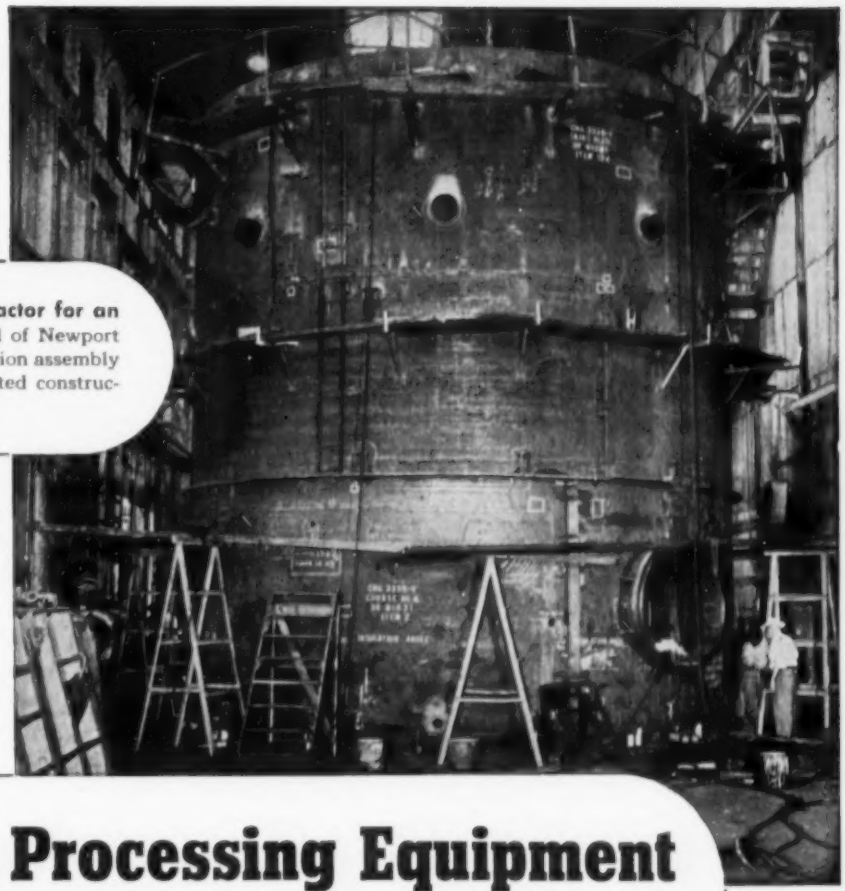
With blanket rolls up to 10 feet wide, in no time at all you can cover any regular or irregular shaped vessel with this flexible glass fiber insulation. What's more, the vessel will be insulated "once and for all" — for Ultralite is a permanent insulation.

When you consider that labor is by far the big item in insulating, it makes sense to select the insulating material that lends itself to the fastest, easiest application. That material is Ultralite, the only insulation of long textile-type glass fibers. Write today for samples, prices, specifications and suggested application methods.

GUSTIN-BACON *Manufacturing Company* GUSTIN gb BACON

Thermal and acoustical glass fiber insulations • Pipe couplings and fittings • Molded glass fiber pipe insulation

266 W. 10th St., Kansas City, Mo.



Course number four of a reactor for an overseas oil refinery. Typical of Newport News plant methods, the precision assembly of this unit in the shop expedited construction of the reactor in the field.

Petroleum Processing Equipment

. . . Built by Specialists in Metal Fabrication

Careful attention to detail characterizes the work of Newport News craftsmen...

They've fabricated millions of tons of steel including corrosion-resistant alloy, clad and other special steels for many diverse industries.

Newport News handles the job exactly as you want it done, for maximum results per dollar invested.

Specialized production techniques, advanced plant methods and a complete range of facilities along with many special purpose machines contribute to the excellence of Newport News fabrication.

Let us bid on equipment for your present or future projects. Learn how Newport News can help you...send for our booklet entitled "Facilities and Products." It's yours for the asking.

Newport News Shipbuilding and Dry Dock Company

Newport News, Virginia

(To obtain more data on advertised products see page 178)

Your motor fuel will not hold its full measure of pep without *RETAINED VOLATILITY*

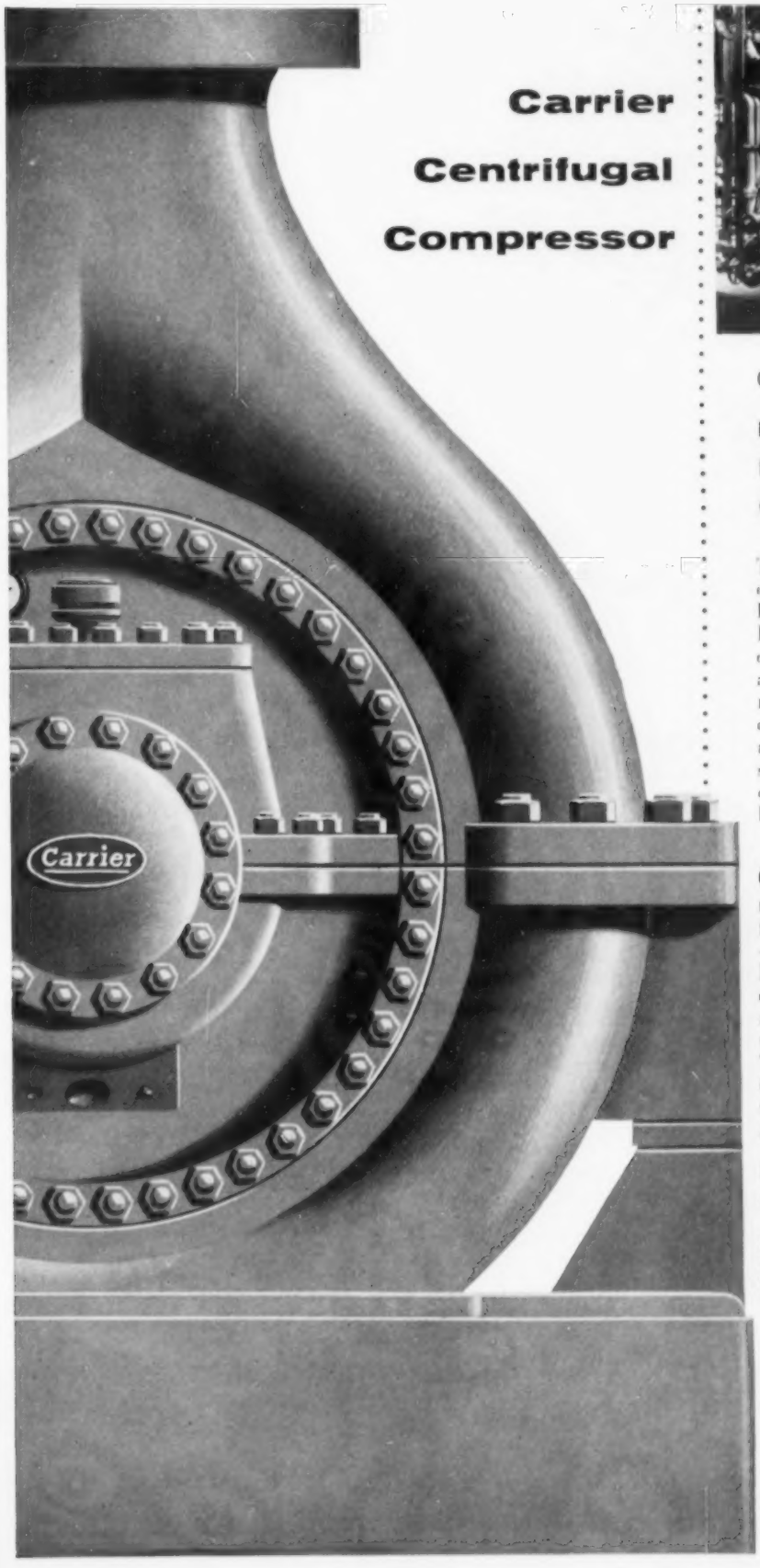
Blend WARREN NATURAL GASOLINE with your present high quality motor fuel to give it superior performance after it reaches your customers' fuel tanks!

WARREN

PETROLEUM CORPORATION

TULSA, OKLAHOMA • Cable Addresses: STAVOLENE, WARREN

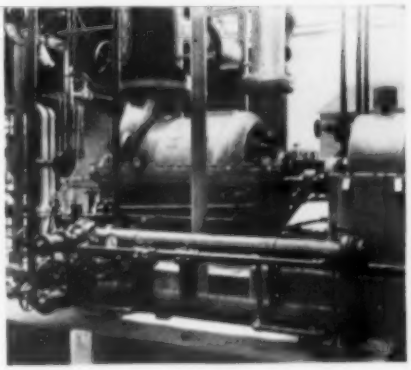
EXPORT TERMINALS: CORPUS CHRISTI, PORT ARTHUR, BAYTOWN, TEXAS CITY AND WARRENGAS, (HOUSTON) TEXAS; SAN PEDRO, CALIF.



Carrier

Centrifugal

Compressor



on the job at

Eastern States
Petroleum
Company

This Carrier Centrifugal Compressor, on the job at the Houston plant of the Eastern States Petroleum Company, Inc., compresses hydrocarbon gas in connection with the sulphuric acid alkylation process. Gas pressure is raised from 18 psia to 115 psia. The compressor is designed to operate at a speed of 7400 rpm. The product of sulphuric acid alkylation has a high octane rating and is employed as a blending agent in aviation gasoline.

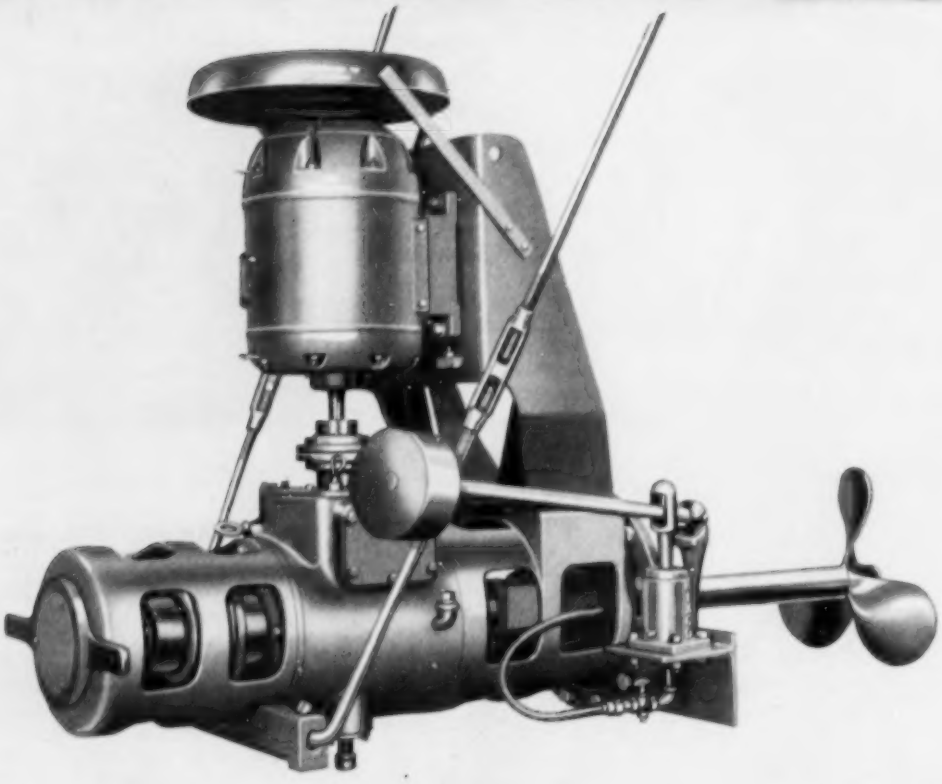
Carrier makes a complete line of centrifugal and axial flow compressors for gas compression and refrigeration—up to 10,000 hp in a single unit. Hundreds of these dependable, efficient Carrier machines are on the job at dozens of refineries throughout the world—serving such companies as The Pure Oil Company, Cities Service Oil Company, Sinclair Oil Corporation, The Texas Company. May we assist you?

If you'd like a copy of our booklet **"Centrifugal Compressors for Industry"** please telephone your nearest Carrier office. Or write Carrier Corporation, Syracuse, New York.

Carrier

centrifugal compressors
refrigerating equipment

(To obtain more data on advertised products see page 178)



This is the mixer **you** *helped design*

You wanted a big-tank mixer that would mix fluids fast—to complete uniformity. But that wasn't nearly enough.

You wanted a mixer you could *forget.* A mixer that would run year in, year out, with the barest routine attention.

You first told us about the need for a shaft bearing that wouldn't have to run submerged in the tank liquid.

That's when we put *ball bearings* in LIGHTNIN Mixers—and moved the bearings back *out* of the tank, away from grit and trouble.

You didn't want to be bothered aligning the mixer when you put it on the tank. So we housed the LIGHTNIN in three rigid castings, joined with concentric rabbet fit that can *never* get out of line, no matter what.

You wanted the gears protected from unusual shock loads—as might happen if the propeller whacked a ladder or other obstruction in the tank. We found the answer for you—in *hollow-quill drive* that isolates the gears from the shaft, protects your investment with a flexible coupling between shaft and gearing.

You wanted to repack the mixer stuffing box quickly—without having to figure out where to put 180,000 barrels of product while repacking. We developed the LIGHTNIN shutoff device that pulls the shaft back like a valve stem, sealing the tank so you don't lose even a pint of product. And we put *handles* on the shutoff because your maintenance men like it that way—out in the open, easy to get at.

But then you got to wondering about the stuffing box itself. Would a rotary mechanical seal do the job better? What about *replacing* the seal, if it ever wore out?

This time, your quest for something a little better *really* paid off. Now you can get a LIGHTNIN Mixer that runs for years *without repacking or adjustment.* No stuffing box. No leakage around the tank. And should the LIGHTNIN Seal ever wear out, you can replace it in *minutes.* No dismantling. No unhitching the mixer from the tank. *No need for special skill.* It's saving oil companies thousands of dollars a year in upkeep!

Thanks to your telling us what you like—and don't like—in a mixer, hundreds of LIGHTNINS have been in service for more than 25 years. More than ever, today's LIGHTNINS meet your needs realistically, in every respect. More reasons than ever before to put LIGHTNINS on *your* big tanks.

For quick, knowing help on fluid mixing, call your LIGHTNIN representative. (He's in Refinery Catalog.) Or write us.

Lightnin® Mixers

MIXCO fluid mixing specialists

CUT MIXER MAINTENANCE 60% with this new LIGHTNIN cartridge-type rotary seal—optional with LIGHTNIN Mixers. It runs for years without adjustment—and slides off the shaft for fast, easy replacement if ever necessary.

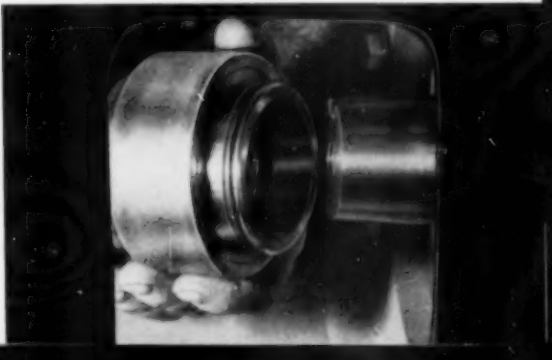
FOR LATEST MIXING INFORMATION and full description of LIGHTNIN Mixers, send for these helpful bulletins:

- ☐ B-102 Top or bottom entering; turbine, paddle, and propeller types: 1 to 500 HP
- ☐ B-103 Top entering; propeller types: ¼ to 3 HP
- ☐ B-108 Portable: ⅛ to 3 HP
- ☐ B-104 Side entering: 1 to 25 HP
- ☐ B-112 Laboratory and small-batch production types
- ☐ B-110 Condensed catalog showing all types
- ☐ B-111 Quick-change rotary mechanical seals for pressure and vacuum mixing
- ☐ B-107 Data sheet for figuring mixer requirements

Check, clip, and mail with your name, title, company address to:

MIXING EQUIPMENT Co., Inc. 131-g Mt. Read Blvd., Rochester 11, N. Y.

In Canada: Greey Mixing Equipment, Ltd., Toronto 10, Ont.



Petroleum Processing
JULY 1956

REVISED FORECAST for 1956 —

(1,000 b/d average)

	at Jan. 1, 1956	at Mid-Year	Up	Down
All Products	9,009	9,179	170 (1.9%)	
Gasoline	3,835	3,888	53 (1.4%)	
Distillate Fuel Oils	1,724	1,771	53 (3.1%)	
Kerosine	331	327		4 (1.2%)
Residual Fuels	1,601	1,622	21 (1.3%)	
Other Products	1,518	1,571	53 (3.5%)	

UPWARD REVISIONS had to be made in almost all forecasts by PETROLEUM PROCESSING in its . . .

Mid-Year Refining Outlook

Twice a year oil company economists and other authorities report to PETROLEUM PROCESSING editors on the petroleum supply and demand outlook. The mid-year roundup reviews the actual trend of the markets for the first six months, as compared with their earlier estimates, and revises the forecasts for the coming six months. The Editors analyze and consolidate the individual reports and present the material in article form.

Contributing to the 1956 mid-year report are authorities with the American Petroleum Institute, Independent Petroleum Assn. of America, Chase-Manhattan Bank, The Atlantic Refining Co., Continental Oil Co., Gulf Oil Co., Socony Mobil Oil Co., Stanolind Oil Co., Standard Oil Co. (Indiana), Standard Oil Co. of California, Sun Oil Co., The Texas Co. and McGraw-Hill Economics Dept., among others.

By V. B. GUTHRIE, Associate Editor

AT THE half-way point in 1956, U. S. refiners face a small increase in demand for all products except kerosine, as shown in the summary chart above.

How are the petroleum industry economists and other authorities viewing this over-all revised picture for the year? Here are the highlights of reports submitted by these authorities to PETROLEUM PROCESSING for its reguar mid-year survey of the supply-demand outlook:

1—The heavy total demand for products in the second quarter of 1956 should not be regarded as a significant stepping up in demand for the last half of the year.

The large gains in refinery product shipments in the second quarter were in the distillate fuel oils and residual fuels. This occurred as a result of continuing consumption of heating oils during the long cold spring over much of the country. Demand for gasoline—and for small volume products—in the second quarter was about in line with forecasts made at the first of the year. Indicated total demand for the second quarter may even turn out to be larger than that forecast for the third quarter. This would be a reversal of previous years, although the difference has been narrowing.

2—Total product demand for the remaining two quarters of 1956—as forecast at mid-year (see table on next page)—will be about the same as estimated at the start of the year, with small increases in shipments of some products and declines in others.

3—Most authorities recognized soft spots in the over-all national economy—for example, automobile and farm implement production. However, they believed these or other factors would not have any more effect on the future usage of petroleum products than was anticipated at the beginning of this year.

4—An adequate operating level for refiners for the third and fourth quarters would be crude runs

Petroleum Processing's Revised Forecast of 1956 Petroleum Demand

(1000 b/d average)

	First Quarter bbl	% Chge. from '55	Second Quarter* bbl	% Chge. from '55	Third Quarter** bbl	% Chge. from '55	Fourth Quarter** bbl	% Chge. from '55	All 1956** bbl	% Chge. from '55
TOTAL DEMAND										
Gasoline	3,490	+ 5.4	4,100	+ 4.9	4,100	+ 4.6	3,860	+ 3.9	3,888	+ 4.7
Kerosine	485	— 0.4	180	+ 9.1	205	— 4.2	440	— 2.7	327	— 0.6
Dist. Fuel Oil	2,450	+ 7.4	1,295	+12.1	1,200	+ 3.4	2,141	+ 4.4	1,771	+ 6.7
Residual Fuel	1,895	+ 1.4	1,490	+ 0.4	1,365	— 0.5	1,740	— 0.7	1,662	+ 0.2
Other	1,450	+12.8	1,580	+ 8.6	1,705	+ 6.5	1,547	+ 3.8	1,571	+ 7.7
Total Demand	9,770	+ 5.8	8,645	+ 5.9	8,575	+ 3.7	9,728	+ 2.8	9,179	+ 4.5
DOMESTIC DEMAND										
Gasoline	3,410	+ 5.6	4,010	+ 5.0	4,010	+ 5.1	3,775	+ 4.3	3,802	+ 5.0
Kerosine	475	— 0.6	170	+10.4	195	— 3.5	435	— 2.7	319	— 0.3
Dist. Fuel Oil	2,390	+ 7.2	1,230	+13.2	1,140	+ 5.5	2,085	+ 5.1	1,711	+ 7.4
Residual Fuel	1,840	+ 4.3	1,420	+ 2.3	1,300	+ 1.3	1,675	— 0.2	1,558	+ 2.0
Other	1,360	+13.9	1,480	+10.6	1,610	+ 7.8	1,455	+ 4.8	1,477	+ 9.0
Total Domestic	9,475	+ 6.5	8,310	+ 6.7	8,255	+ 4.9	9,425	+ 3.4	8,866	+ 5.3
Total Exports	290	—14.5	335	—11.8	320	—18.6	303	—12.7	313	—14.2
CRUDE RUNS TO STILLS AND CRUDE PRODUCTION										
Crude Runs	7,990	+ 7.5	7,650	+ 4.8	7,850	+ 4.0	7,960	+ 4.2	7,865	+ 5.1
Crude Production	7,190	+ 5.3	7,050	+ 4.8	7,000	+ 4.9	7,130	+ 1.8	7,909	+ 4.2

Forecast of Adequate Levels for Refiners' Product Stocks (1,000 bbl)

	Mar. 31, 1956***	June 30, 1956	Sept. 30, 1956	Dec. 31, 1956
Gasoline	199,700	170,700	160,700	168,000
Kerosine	17,200	28,500	36,100	27,700
Dist. Fuel Oil	60,850	100,000	146,500	116,800
Residual Fuel	33,000	39,300	44,000	40,300
Other	97,800	103,000	99,000	97,700

*Estimated. **Forecast. ***Actual. Note: 1956 has one extra day because of Leap Year.

averaging 7,905,000 b/d. This would provide for meeting supply needs and bringing inventories up to desirable levels. An adequate level for the entire year would be an average of 7,865,000 b/d.

5—Product imports—principally residual fuel oils—and the amount of natural gas liquids processed are factors in meeting product demands. Product imports are now estimated to average 510,000 b/d for all of 1956, and natural gas liquid processing about 780,000 b/d.

6—Without considering the economic justification for an advance in the price of crude in U. S. fields, most authorities pointed out that supplies in May were increasing at a faster rate than product demand. If this situation were to continue, they did not expect a general advance in the prices of U. S. crudes this year.

Product inventories at refineries today show the effect of both the large runs of crude oil to stills during the early months of the year, and the unexpected demand for heating oil products. Refiners in coming months must operate to reduce gasoline stocks to the desired level by the end of the third quarter, and at the same time to build up distillate fuel oil stocks, which were reduced below the 1955 level, so they will be an adequate bulwark against the needs of the coming heating season. One method, a reversal of the general practice in the early summer, would be to reduce gasoline yields from crude and increase distillate fuel oil yields.

PETROLEUM PROCESSING's revised forecast of 1956 product demand, made from the midyear vantage point, indicates:

All Products: Total demand at refineries for the year will average 9,179,000 b/d, an increase of 398,000 bbl (4.5%) from actual demand for 1955. This is even higher than the PETROLEUM PROCESSING year-end forecast of 9,009,000 bbl, due principally to the large actual increase in use of distillate fuel oil for home heating in the second quarter.

Gasoline: Demand for all of 1956 will average 3,888,000 b/d, 4.7% greater than actual demand of 3,714,000 b/d for 1955. Our year-end forecast was for total gasoline demand to be 3,835,000 b/d avg.

Distillate Fuel Oils: Total 1956 demand revised upward to 1,771,000 b/d avg., 6.7% greater than the 1,660,000 bbl actual demand for 1955. The large increase from our earlier forecast of 1,724,000 b/d is due to heavy second quarter demand.

Kerosine: Over-all 1956 demand will be 327,000 b/d avg., a trifle under the actual demand for 1955, also a little under the earlier forecasts. A steadily growing volume of kerosine production at refineries is going into jet fuels, which are reported separately.

Residual Fuels: Over-all 1956 demand will be around 1,622,000 b/d avg., only a fraction of a percent higher than actual in 1955, and also not much of a change from the earlier forecast of 1,601,000 b/d avg.

Other Products: Made up of jet fuels, lubricating oils and wax, asphalt, liquefied petroleum gas and others. For the first six months, demand is now estimated at 1,515,000 b/d avg., 10.7% greater than actual demand for the same period in 1955. For the last six months, demand for this class of products is forecast at 1,625,000 b/d avg., about 5% higher than actual demand for the last half of 1955. For all of 1956, shipments of these products are now forecast at 1,571,000 b/d avg., a gain of 7.7% from 1955. The current forecast is more than 50,000 bbl daily larger than was forecast at the start of the year.

The Petroleum Processing Maintenance and Construction Panel

This month's M & C Feature:

Decisions Cost Money

Why not try pre-planning on your next Maintenance & Construction Job?

By F. O. PIERSON
Chief Manufacturing Industrial Engineer, The Atlantic Refining Co.

ONE big maintenance cost is getting a "management" decision. Too much of management's time is spent on these decisions, or time is lost waiting for a management decision.

Decisions are variable in some situations——one thing one time, another the next. Sometimes maintenance cost is high because of an unwise decision.

Expensive decisions abound in maintenance work. Why? Perhaps because we consider maintenance as nonrecurring or emergency work, and each job is handled as a separate entity.

Preventive maintenance has taken the timing of maintenance out of the realm of chance (breakdown) and spasmodic management decision. "We'll do some maintenance now because production is slack."

The basis of preventive maintenance is engineering inspection, and the time for doing the work is adjusted within narrow limits to meet production needs.

A maintenance work method (how to do the particular job) is often decided on the spot by the foreman assigned to this job, or by his superior. This management decision is often costly. On the one hand it may require too many supervisors in the maintenance department, and on the other hand it may give undue weight to one craft's problems without considering the needs of supporting crafts used on the job. Sometimes, these spot decisions are costly because they're unsound, and seldom is the decision consistent with past (or future) practice.

Can maintenance decisions be made in advance? Yes. In refinery maintenance, most of these decisions can be made long before it's necessary to do the job. The decision can be made, then studied and discussed until all concerned agree that "if" such a thing happens, or has to be done, "this" is the best way to do the job.

This premaking of management decision is called "Standardization" by the industrial engineer.

Craft Standardization

There are two main types of standardization—craft and job. Craft standardization is basic and should be considered first.

In its simplest form, craft standardization is the approved way a workman is instructed to do a portion of his job.

The standardization may be relatively non-technical—how a mechanic mounts two hack-saw blades in opposed arrangement in order to cut thin wall tubing for instance. On the other hand, the instructing decisions may be technical, i.e., the electrode size to use on a given size of metal in order to make a specified type of welded joint.

Work sequences represent another type of management decision that can be predetermined for maintenance work.

Examples of this craft and sequence standardization are shown in Fig. 1 for two classes of work—carpentry and rigging. (Other examples were shown in Mr. Pierson's previous article—see Meet the Author.)

Tool Standardization

Methods and work sequences alone do not allow complete work standardization. Tools, and the limits to which they will be used, must also be stand-

Meet the Author

Mr. Pierson

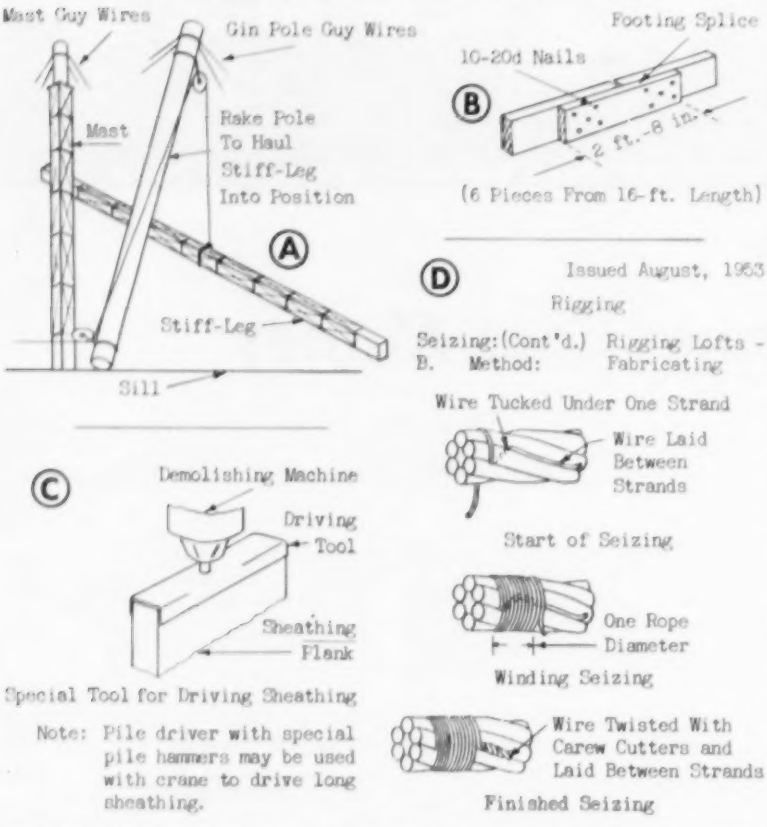
Frank O. Pierson, Chief Manufacturing Industrial Engineer, The Atlantic Refining Co., Philadelphia, Pa., was born in 1903 at Cromwell, Conn. He received a B.S. degree from M.I.T. in 1929, specializing in Engineering Administration and Industrial Engineering.

His experience includes positions with Kenneth A. McIntyre Assoc., E. I. du Pont, Standard Gas Equipment Corp., Hyatt Bearings Div. of General Motors Corp., International Paper Co., and his present position with Atlantic.

Mr. Pierson is an active member of the Industrial Engineering Group of the American Management Association and is a special lecturer at Rutgers University at New Brunswick, New Jersey.

Mr. Pierson was the Author of "Standardized Maintenance Pays," PETROLEUM PROCESSING, July, 1955, pp. 996-1001, in which he describes the growth of Atlantic's Industrial Engineering program.

Standardization Makes Decisions Easier—Fig. 1



RIGGING ILLUSTRATION (A) shows how jobs can be standardized for workmen. If a stiff-leg must be placed in position, job will be done as shown, eliminating possible bottleneck decision. Footing splices can be standardized as shown in (B). (C) shows how use of tools can be standardized. Procedure for seizing on wire cable is shown in three-step sequence (D).

arized. For instance, it would be difficult to plan a carpenter's work, and know what performance to expect from him if the planner did not know in advance what tools were to be used (when he is to use a hand saw, when to use a power saw, etc.). Fig. 1 also gives an example of tool standardization.

Job Materials

Another prior decision that can be made is the materials specification for a job situation. These decisions are relatively easy to make in advance, as shown in the examples in Fig. 2.

Job Standardization

Many jobs need the coordinated efforts of several different mechanics. Work sequences, craft balance and respective areas of activity are all types of decisions management can make in advance. These decisions can be outlined in the company's standard practice manual.

Examples of such standardization are too complex to illustrate in an abbreviated article. However, a general description of an exchanger maintenance procedure would include a listing of the tools and materials needed by riggers, exchanger repairmen and carpenters (staging and shoring). Work sequences and methods are spelled out, cleaning methods and materials listed, testing procedures are spelled out, replacement gasket stores numbers listed, etc. Also, the gang size and need for auxiliary services are shown.

One benefit of job standardization is that repetitive and prior known parts of maintenance work can be planned in advance by staff men. This frees the working foreman of much desk work, and lets him get into the work area to follow work progress, keep men on the job, anticipate interruptions, eliminate waste motions, and other duties.

General Information

Under this title are the various bits of frequently used information that, while not greatly significant, are convenient to planners. Examples of such general information are shown in Fig. 2.

Standard Practice Manuals

All the preceding information is compiled in a series of Standard Practice Instruction Manuals (SPI's) according to craft and job groupings. Though mainly designed to help the job planner and foreman, others are helped by these manuals.

Operating foremen of the manufacturing department can use them more adequately to describe the nature of repair work desired. Maintenance inspectors can examine job quality with regard to procedure and final acceptance, and can spot irregularities in job development that may impair quality. The engineering department can compare construction and maintenance practices and materials and can compare company practices and materials with contractor's specifications. The industrial engineers use SPI's to develop time values for doing the work, or to evaluate work methods approved by the maintenance personnel.

Engineered Planning Times

Time values for over-all jobs can be developed following the basic pattern of the SPI's. First, simple single craft work times were developed (see Figs. 3, 4). These simple work times were then grouped into job time values—sometimes for a single craft (Fig. 5), sometimes for several crafts (Fig. 6).

We call job time values Engineered Planning Times (EPT's).

NOTE: The remainder of this article is from the copyrighted manual, "Examples of Standard Practice Instructions and Engineered Planning Times," and is not to be duplicated in whole or in part without permission of The Atlantic Refining Co., 3144 Passyunk Ave., Philadelphia, Pa.

Practical Time Values

Engineered Planning Times (EPT's) represent normal productive expectancy for base wage performance. The time values include necessary allowances to cover all practical conditions incident to performing the work. These allowances reflect crew balance time when it is normal procedure to assign a craftsman and a helper to a job.

When craftsmen representing different crafts work simultaneously on a job, a man of one craft may normally have to wait, or stand-by, while a man of another craft is working on the equipment. Service craftsmen, such as

riggers, may have considerable standby time between periods when they perform their functional part of the job. As another example, when working inside hot furnaces, crews may be rotated, one group inside working while another group is recuperating outside. These delays are all included within the development of the EPT's.

Other allowances cover conditions such as height allowance—an additional credit time for craftsmen to remove and resecure safety belts, to secure tools laid aside so they will not be accidentally knocked off a scaffold or ladder with possible injury to workmen below.

Therefore, the EPT's represent practicably attainable values. It should be noted, therefore, that these time values have been developed by the Industrial Engineering Division to reflect working conditions peculiar to the Philadelphia refinery of The Atlantic Refining Co. Such time values are probably unsuitable for use by any other agency.

Before final endorsement for use, these values are tested on one or more jobs. In this way, job foremen are made aware that these values have not only been developed with the intent to represent practical attainment, but also that this practicability has been field tested.

Nature of Work Covered

Maintenance and construction work differs from productive work in its degree of repetitiveness, the variability of sequence of operations, and similar characteristics. Management also faces problems of forecasting that are more complex. In order to give fullest value to these EPT's, they have been precombined to give quick answers to many different questions.

EPT time data have, therefore, been combined, or consolidated, in various ways so as to be of greatest service to the planning engineers, material men, job foremen and management.

Development of EPT's

The basic EPT's have been developed on a craft basis. The planning times provide a wide range of coverage for activities normally performed by the respective crafts. Values are available for the small jobs which may be done by a single craftsman in a short time to the larger jobs which require as many as several gangs of craftsmen with helpers.

For example, times are available for the relatively simple repair job done by a boilermaker of inserting a ¾-in. pipe plug in a steel tank shell to seal off a leak, or for a somewhat larger

Job Materials and Other Data Can Also be Standardized—Fig. 2

PIPE LINE SUPPORT SHORE (Sketch No. 5)

Use: New Construction

Horizontal Shore	2 in. x 10 in.	2
Bolts	5/8-in. diam. bolts with nuts and washers, length to suit job	4
Blocking	2 in. x 10 in., 2 in. x 4 in., 6 in. x 6 in., etc.	As needed

JOB MATERIALS specified by prior decision are shown in these specifications for pipe line support shore materials

THICKNESS OF INSULATION

Operating Temperatures °F.	Thickness (Inches)	No. of Layers
-20 to + 4	6	2
+ 5 to +19	5	2
+20 to +34	4	2
+35 to +44	3	1
+45 and over	2	1

INSULATION SPECIFICATION shows thickness and number of layers for several operating temperature ranges

SAFE LOADS OF PLOW STEEL

Rope Diam., Inches	Wire Rope Construction			
	6 x 19	6 x 7	6 x 37	18 x 7
	Tons			
3/4	4.1	4.0	3.9	3.8
7/8	5.6	5.4	5.3	5.1
1	7.3	7.0	6.9	6.7
1-1/8	9.2	8.7	8.7	8.4
1-1/4	11.3	10.6	10.7	10.3
1-3/8	13.6	12.3	12.9	12.4
1-1/2	16.1	15.0	15.3	14.7
1-5/8	18.8	---	17.9	17.1
1-3/4	21.6	---	20.6	19.8
1-7/8	24.6	---	23.6	---
2	28.0	---	26.8	---

GENERAL INFORMATION, such as these details on wire rope used for rigging computed on a safety factor of 5, can also be standardized

Item	Load
Dead Load of Concrete	150 lb/cu. ft.
Assumed Construction Live Load	75 lb/cu. ft.
Assumed Live Load After Pouring	40 lb/cu. ft.

AUXILIARY INFORMATION on concrete bases permits planner to compute practical size of base before selecting proper concrete design, insuring that company requirements that pump or motor base weigh 2½ times as much as equipment are met

For	Type of Insulation	Band Size	Approximate Feet per Pound	
			Aluminum	Stainless
Pipes	Mag. or H.T.	3/8 in. x 0.010 in.	---	80
		3/8 in. x 0.020 in.	100	---
	Cork	3/8 in. x 0.010 in.	---	80
		3/4 in. x 0.015 in.	---	25
Vessels	Mag. or H.T.	3/4 in. x 0.015 in.	---	25
	Cork	3/4 in. x 0.015 in.	---	25
		3/4 in. x 0.020 in.	---	19

STANDARDIZED auxiliary information on pipe covering helps in getting proper type and quantity of materials needed for a job

These Forms are Used to Develop Time Values for Individual Jobs and Single Crafts—Figs. 3, 4, 5

FIELD CARPENTRY unit time values for figuring concrete form time estimates

CONCRETE FORMS

Type of Form	Unit of Measurement	Man Hours per Unit		
		Field Fabrication	Install Forms	Total Fabricate and Install
Footings	sq. ft.	----	----	.18
Retaining Walls (Keyed Type)				
(a) Sheathing of 3/4 in. Plywood	sq. ft.	.04	.16	.20
(b) Sheathing of 1x8 in. Lumber	sq. ft.	.06	.16	.22
Pump Foundations	sq. ft.	.07	.17	.24
Pipe Conduits	sq. ft.		.19	.27
Sewer Boxes	sq.		.19	.25

FIELD CARPENTRY unit time values for figuring wood shore time estimates

WOOD SHORES

TYPE OF SHORE	Vertical Height of Shore	Height of Shore Above Ground: 0 ft. to 10 ft. — Man Hours Per Shore			Height of Shore Above Ground: 11 ft. to 20 ft. — Man Hours Per Shore		
		Erect	Dismantle	Total	Erect	Dismantle	Total
PIPE LINE SUPPORT SHORE	---	4.5	1.5	6.0	6.0	2.0	8.0

INSTALL HEAT INSULATION, PIPE LINES AND FITTINGS

Nominal Pipe Diam. (Inches)	Construction of Insulation (See Note 1)	Sht. Sect. of Pipe/ft. Over 2 ft. (See Note 2)	Pipe Bends /Foot of Run	One Pair of Flanges	Screwed, Welded or Body of Flanged Fitting Only: Tube Turn or Elbow 45°	Tube Turn or Elbow 90°	Valve, Tee or Swaged Nipple	Flanged Valve or Tee Complete	Flge. Only of Blind Flange
1 and under	C.M. or K.	.13	.42	1.0	.25*	.50*	.6*	3.0	.10*
	C.M.	.22	.79	1.4	.38**	.75**	1.1**	4.2	.20**
	C/C.K.	.30	1.1	1.9	.50	1.0	1.5	5.7	.27
1-1/2 to 4	C.M. or K.	.15	.57	1.3	.40	.80	.8	3.9	.32
	C.M.	.25	.87	1.8	.60	1.2	1.2	5.4	
	C/C.K.			2.3	.75			6.9	
				1.5	.65				
			.88					8.4	
	C/C.K.	.48	1.3	3.	3.2	6.3	3.0	12.0	1.
		.50	1.5	4.2	3.5	6.9		15.0	2.1
14	C.M. or K.	.35	.97	3.2	2.7	5.4	2.1	9.6	1.6
	C.M.	.54	1.5	4.5	4.0	8.1	3.5	14.0	2.0
	C/C.K.	.56	1.6	4.7	4.3	8.5	3.5	14.0	2.1
16	C.M. or K.	.40	1.1	4.0	3.4	6.8	2.7	12.0	1.8
	C.M.	.60	1.6	5.6	5.1	10.2	4.0	17.0	2.2
	C/C.K.	.64	1.7	5.9	5.5	10.7	4.2	18.0	2.5

Notes: 1. The K.P.T.'s include:
a. Apply one or two layers of heat insulation as follows:
(1) C.M. or K. indicates one layer of Magnesia or Kaylo Pipe Insulation or one layer of Magnesia block insulation.
(2) C.M. indicates two layers of Magnesia pipe or block insulation.
(3) C/ or C/C. indicates combination pipe or block insulation consisting of one layer of high temperature and one layer of Magnesia insulation or two layers of Kaylo pipe insulation.
(4) Items marked (*) are usually covered with insulating cement. The thickness of insulation in inches is indicated by the number of (*'s).

PIPE WORK unit time values, left, for insulation, pipe lines and fittings, make decisions easier and surer

POSITION LOADS

Weight of Load	Man Hours per Load	
	Position	Remove
Up to 100 lbs.	.04	.03
Over 100 to 500 lbs.	.15	.09
Over 500 to 1,000 lbs.	.40	.24
Over 1/2 to 1 Ton	.77	.43
Over 1 to 2 Tons	1.00	.70
Over 2 to 5 Tons	1.50	1.00
Over 5 to 10 Tons	2.00	1.50
Over 10 Tons	2.50	2.00

Planning Times Include:

Position:
Maneuver or manipulate load to required position.
Secure load (by bolts, clamps or other means) to enable removal of rigging gear.

Remove:
Remove bolts, clamps, or other device securing load in position.
Manipulate load out of position.

Planning Times Do Not Include:

Lash load for movement. (See K.P.T. 11-100, Table No. 1.)
Move load. (See K.P.T. 11-100, Table No. 2.)

Position or remove load is not to be applied where a load is not secured in its operating position, or where a load is to be stored.

Fig. 6—Consolidated time values for a single craft are shown in this form

Multi-craft charts simplify decisions on complicated charts—Fig. 7

PIPE LINE CONSTRUCTION

Authorization Or Job. No. _____ PRELIMINARY PLANNING ESTIMATE Zone _____

Job Description _____ Engineer _____

Scheduled Starting Date _____ WELDED PIPE LINES UNDERGROUND Date Of Preliminary Estimate _____

Field Operations Include	Pipe Size, In.	Man Days For 100 Lin. Ft. Of Pipe Line							Necessary Crafts		
		Yard Laborers	Riggers		Pipefitters		Welders		Total Man Days/ 100 Lin. Ft.	Total Lin. Ft.	Total M. Days
		Non-Insul.	Std.	XH	Std.	XH	Std.	XH			
Welded Pipe Lines Underground With Excavation & Backfill Performed Manually:											
(1) Yard Laborers: Manually Excavate Pipe Trench 3' Deep, Load Clay on Truck Or Skid, Load Clay Into Wheelbarrow, Wheel Clay, Pack Clay Around Pipe, Excavate & Backfill to Relocate Existing Pipe Lines, Unload & Load Blocking Lumber, Coat Pipe With Asphalt Emulsion (Furturtite), Backfill Pipe Trench, Tamp Where Necessary, Dispose of Excess Excavated Material, General Area Cleanup, Misc. Work (Place & Remove Safety Planks, Barricades, Blinker Lights, Etc.)	1-1/2	7.9	.4	.6	4.2	4.3	.9	.9			
	2	8.6	.8	1.3	4.7	4.9	.9	.9			
	2-1/2	9.3	1.3	1.3	4.7	4.9	1.3	1.6			
	3	10.1	1.3	1.3	5.2	5.4	1.3	2.2			
	3-1/2	10.9	1.3	1.3	5.2	5.4	1.6	2.2			
	4	15.0	1.3	1.5	5.3	5.4	1.8	2.7			
	6	16.7	1.5	1.6	6.3	6.4	3.6	5.1			
	8	18.3	1.6	1.7	6.7	7.0	4.9	4.9			
(2) Riggers: Lower Pipe Sections Into Trench. Rig to Relocate Up To 4 Existing Pipe Lines per 100 Lin. Ft. Of New Pipe Line.	10	20.4	1.7	1.8	7.6	8.0	5.2	6.0			
	12	22.3	1.7	1.8	7.9	8.5	5.5	8.6			
	14	24.0	1.8	1.8	8.4	9.1	5.1	9.3			
(3) Pipefitters: Measure Pipe Sections, Make Set Ups For Welding, Test Welded Pipe Sections, Make Flanged Joints, Relocate Up To 4 Existing Pipe Lines Per 100 Lin. Ft. of New Pipe Line.	16	26.1	1.8	2.0	9.1	9.7	6.3	12.2			
	18	27.9	1.8	---	9.6	---	7.9	---			
	20	29.7	1.8	---	10.1	---	8.5	---			
(4) Welders: Weld Butts, Flanges And Branch Connections (Saddles).	24	33.8	2.0	---	10.9	---	13.4	---			
Craft Totals/Pipe Line											
Welded Pipe Lines Underground With Excavation & Backfill By Power Equipment											
(1) Yard Laborers: Load City Into Wheelbarrows, Wheel Clay, Pack Clay Around Pipe, Unload & Load Blocking Lumber, Coat Pipe	1-1/2	1.0	.2	.6	1.5	1.5	.3	.3			
	2	1.2	.6	.6	1.7	1.8	.3				
	2-1/2	1.4	.6	.6	1.7	1.9					
	3			.6	1.8	2.0					
	3-1/2				1.8	2.0					
					1.9						

job of replacing an 8-ft x 22-ft sheet plate in the shell of the tank.

Finally, tables of time values are provided which give the total boilermaker time required for the complete erection of either riveted or welded steel tanks of varying dimensions. In addition, "multiplier" type standards are provided for applicable conditions.

A pipe may be leaking. Times are available for replacing a single section —flange to flange. If several sections need to be replaced, the same value multiplied by the number of flanged sections affected provides the pipefitter time required. Tables are provided which supply these values for varying pipe diameters, also based upon whether the pipefitters actually remove and replace the pipe—or different time values if service craftsmen (riggers) do the pipe handling.

From the various craft EPT's, multicraft job EPT's have been consolidated. As an example, a storage tank is to be built. Consolidated EPT's supply time values for yard laborers for preparing the job site and laying the clay tank pad. Boilermaker's time requirements, the welders, carpenters in erecting and dismantling scaffolds, painters, etc., are all provided for in the consolidation.

For those operating units subject to periodic maintenance shutdowns or "turnarounds," the forecasts of labor requirements are developed well in advance of the shutdown period. "Packages" have been developed for work items which, of necessity, occur every shutdown. These time values cover the erection and dismantling of scaffolds,

safety valve removal and replacement, blanking of lines, etc.

These "packages" are normally applicable for successive shutdowns of the specific operating unit. Known repetitive work items, not necessarily done each shutdown, are added to the above time requirements as they are scheduled to occur.

"Book items," those items reported by the unit operators as requiring attention during a forthcoming shutdown, are then added to the above-known work load to determine the total known work content for planning and scheduling purposes prior to the shutdown date.

Unanticipated jobs, necessitated by inspection during the shutdown (normally approximating 15-20% of the total work volume) are covered by job orders. Time values are immediately supplied for these jobs and the allowed time is entered into the master schedule.

The shutdown is, therefore, conducted on a completely planned basis and labor requirements, by craft, may be determined and supplied with a high degree of accuracy. In order to avoid extending the elapsed shutdown period, manpower may be transferred from jobs of lesser priority throughout the plant to accommodate the unanticipated jobs that arise during the shutdown period.

Advantages of EPT's

While much of the EPT data that are provided may be used for day-to-day or job-to-job control of maintenance work, an important value lies in the excellent tool that is provided management for long-range forecasting of maintenance work loads.

From experience, management can predict the number of operating unit turnarounds forecasted for the coming year. From the shutdown EPT's the known work load for each unit can be forecasted. To this is added an allowance to cover the normal additions to turnaround work load (approximately 15-20% of the total).

Thus management can obtain a forecast—for at least a year—of the turnaround work load. Since these EPT's specify the work by craft, this means a work load forecast by craft.

Since much of the major authorization work involves new construction of pipe lines, tanks and replacement of major components of tanks, such as roofs, bottoms, heating coils, etc., the large multi-craft consolidated EPT's have been developed which reflect the labor requirements, by craft, for this work. Since authorization work is estimated long in advance of execution, a good forecast is provided of the work load, by craft, included in these authorizations.*

An estimate of small job maintenance requirements, when added to the two large forecasts for turnarounds and authorization work, gives management a reliable long-range forecast of manning requirements by craft.

Because the refinery covers several hundred acres, the maintenance and construction work load is handled from four geographical divisions called zones. Work load requirements within zones vary considerably. During a given period, one zone may be heavily loaded with necessary maintenance work. A short time later, it may be a different zone.

At all times there are minor fluctuations which change the relative load on the various crafts. These variations require the interchange of craftsmen —and job foremen—between zones. These changes are planned a week in advance. Consolidation of EPT's into units that include the amount of work normally performed in a week or so helps the central planning organization hold these interchanges to a minimum.

Flexibility in Application

The EPT's are developed so that small craft job consolidations may be readily computed even when job content is subject to variations. For example, a heat exchanger may require servicing; something is wrong inside. Assume it is not known what is wrong. We would have one consolidation of time values for removal of heads and inspection.

After inspection, one or more steps of repairs would be selected. There are consolidated EPT's for each of the possible choices. After this, the unit is tested. If it passes the test, the exchanger is reassembled. Thus there are three possible divisions of this one job. There are three EPT consolidations to give the craft time requirements.

If finer detail is desired, these consolidations may also be developed on a "one at a time" basis or "several at a time" basis. Again, the exchanger repair can illustrate the principle of development.

During a turnaround, a large number of exchangers are normally serviced. The service crews of riggers and carpenters are moved from job to job, as needed, setting up scaffolds and runways, installing chain hoists, removing covers and channel boxes, pulling bundles from exchanger shells, etc. Standby time for these service crafts can be kept to a minimum due to the volume of work available for them in the immediate area. But, on a single exchanger repair job, the carpenter and rigger crafts have a considerably larger amount of necessary stand-by time. To adjust for situations of this type, different consolidations may be developed to apply in each of the above cases.

Materials and Equipment

The EPT's have been developed on the basis that the necessary supplies, materials, tools and special equipment have been ordered and delivered to the job site, available to the craftsmen as needed during the progress of the job. For those crafts whose work requires large volumes of varied materials for a given job the SPI lists the material requirements.

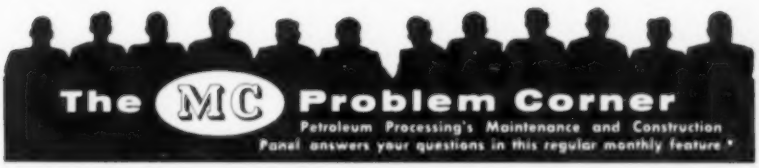
For example, the field carpentry SPI lists the quantities and sizes of pipe required as component parts for the erection of a pipe scaffold of given dimensions. Also included are the specific requirements for pipe scaffold, clamps, ladder sections, and lumber for decking and toe-boards.

In the multi-craft EPT consolidations, to cite "Erect Storage Tanks" as an example, supplies such as paint, welding rods, scaffolding materials, materials required for firebank construction, etc., are predeveloped in tabular form. The forms provide for material requirements over and above those normally specified on the bill of materials included in the engineering drawings, and would ordinarily consume much time and effort on the part of the planning engineers and material men for each individual construction job.

Other tables are provided which convert supplies and material requirements into stock order quantities. For example, in construction of a pipe line the backfill requirements of clay are published in yards and converted to skid loads, 1½ or 3 ton truck loads, etc.

Because of these consolidations and predetermined ordering standards, estimating or target development requires a minimum of clerical time and effort. As is true in all types of maintenance or construction activity, determination of work content, and major decisions as to how to do the work, take a big part of the planning engineer's time.

*The term "authorizations," as used here, refers to large construction or rebuilding jobs for which the cost exceeds a stipulated sum of money.


The MC Problem Corner
Petroleum Processing's Maintenance and Construction
Panel answers your questions in this regular monthly feature *

Oil from our instrument air compressor carries through the dryer and into the instrument line, causing much extra maintenance work. Do you have a solution to the problem?

C. L. A., Refining, Rocky Mountains

Air compressor installation is critical. Adequate after-cooling is needed. A second after-cooler (using cooler well water during hot summer months) might be needed. Traps are needed, and accumulated oil and condensed moisture must be drained properly.

A mist-extracting pad or suitable "centrifix" type extractor in the air receiver drum (above the air inlet or at top outlet connection respectively) should be installed and drained at regular intervals.

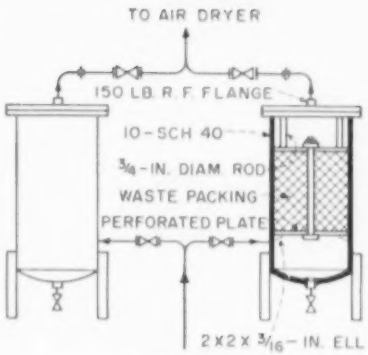
Air compressor lubrication involves problems of potential oil carryover and explosions.

For force-feed lubrication systems, a minimum amount of oil should be used. Compressor manufacturers usually recommended a lubrication rate of one-tenth pint SAE 40 oil per 1000 sq ft wiped surface. This rate can give considerable oil carryover into discharge headers and the following dryers.

Lubrication can be reduced to as little as one-hundredth pint per 1000 sq ft wiped surface (with caution), thus almost entirely eliminating carryover, yet giving good lubrication. This reduction in lubrication rate should be done by cautious degrees so that effects can be noted over a period of time.

Combustion danger (resulting from excess oil or carbon wiped off the piston and accumulating in the discharge values and lines) can be reduced by using a non-carbon producing lubricant, such as Celanese Cellulube 220. In one installation, the Cellulube gives no carryover, and has resulted in a 50% increase in silica gel dryer life.

A pre-filter drum, packed with activated alumina or other porous material, placed ahead of the air dryers can remove excess compressor cylinder oil carryover. This drum is generally recommended and supplied by the dryer manufacturer, or can be shop fabricated as shown in the accompanying sketch.



Regenerative drying equipment has eliminated the problem of oil carryover, when properly operated and sized. These units are commercially available with either manual or automatic switching equipment.

Some of these dryers have operated at one refinery since 1948, giving excellent service with little maintenance and no clay changes.

Can you recommend a rod packing that will stand up under 15,000 psig pressure in our ammonia compressors?

Petrochemicals, Southwest

It is a common error to blame the packing when a pump is not working correctly. Other factors may have even greater influence. Therefore, it is recommended that basic fundamentals be studied before plunging into an expensive and unneeded experimental program in quest of a better packing.

Special packings are needed, however, and should be specified to compress hydrogen to 15,000 psig in the ammonia synthesis process. Conventional packings usually furnished with the equipment will not seal pressures in this range.

Pressure, temperature, contamination, corrosion and permissibility of lubrication must be considered in designing a high pressure packing. For the application in question, Hyper Compressor Packing, made by France Packing Co., Philadelphia, Pa., is highly recommended.

Compressor alignment is one of the important basic compressor fundamentals. At high pressures, misalignment causes friction, heating and plunger rod distortion. A weaving rod gives the packing segments a radical motion causing both rod and packing case wear.

Alignment is possible by using very rigid construction, and both vertical and horizontal adjustments built into the connection of the plunger rod to the cross head—also giving some flexibility to offset misalignment.

Packing should never be a bearing or support to align the plunger rod. Total runout of a plunger rod should never exceed 0.001 inches in either direction as the plunger rod passes through its cycle of stroke.

Plunger rod material should be determined for its particular service. If corrosion is not a factor, a rod of tough material and hard surface wears well.

The rod's surface hardness should be uniform over areas contacting the packing, or it will wear unevenly. Surfaces of this type are possible by heat treatment, nitriding, carburizing, or chrome plating. Sprayed metal on the rod is not successful.

Hardness of surface hardened rods should be kept at a Rockwell "C" of 60. Keep heat treated rods at 36-38.

Surface finishes on piston rods should be 4-6 micro inches. Finishes in packing cases and segments should not be less than 8 micro inches.

The running-in time, once deemed necessary for a good seal for a piston rod and packing assembly, is actually a wearing out process, and any surface finish condition other than superfinishing is usually subject to leaking.

Once a leak develops with superpressures, it cuts into the packing, and at times the piston rod. In a short time, this leakage is destructive to the installation.

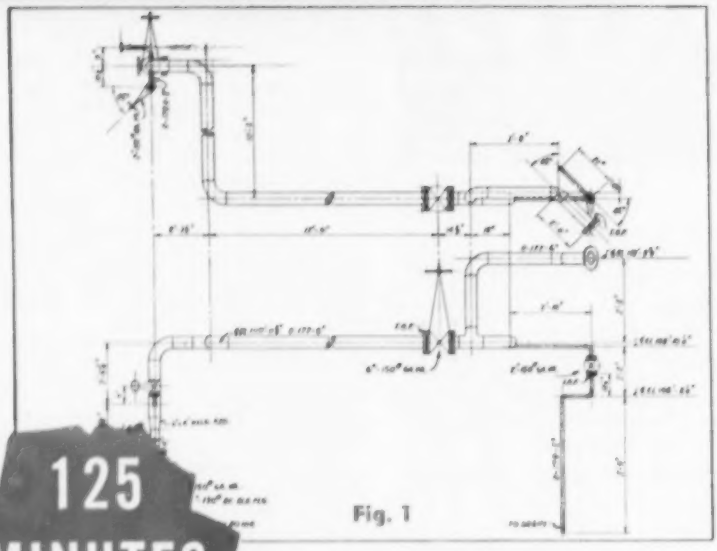
Lubrication can be affected by, or can effect, the actual process in superpressure operations; therefore, it is a determining factor in selecting materials of construction.

Bronze packings and steel piston rods, together with a suitable lubricant injected at the external or low pressure end of the packing (straight mineral oil—naphthenic or paraffinic) make a good combination for compressing hydrogen.

***Got a Problem?**

Why not send it to the M&C panel. Your questions should be specific, and on maintenance and construction. Include a sketch of photo if needed. But please limit each question to one subject. Address them to:

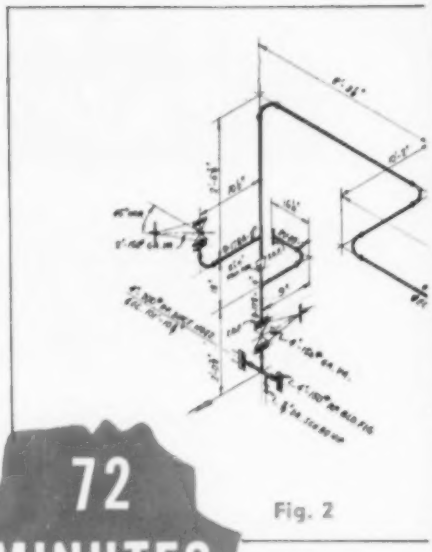
M&C Editor
PETROLEUM PROCESSING
330 West 42nd Street
New York 36, N.Y.



125 MINUTES

Fig. 1

Conventional Pipe Detail



72 MINUTES

Fig. 2

Single-line

These Drawings All Show the Same Information and Detail —

AN EXPERIMENT IN DRAWING: The piping detail shown in Fig. 1 was drawn in 125 minutes, the one in Fig. 2 in 72 minutes, and the one in Fig. 3 in 31 minutes. All three drawings give the same detail, have the same amount of information, and were made under identical conditions. They were made specifically for this experiment.

All three drawings were with pencil using the equipment shown in Figs. 4, 5 and 9 on pp. 80-81. For comparative purposes, Fig. 1 presented as a single line drawing would have taken 72-125 minutes to draw.

Try to visualize the pipeline as drawn in Fig. 1. Even an experienced draftsman needs considerable time to visualize it, and for the men in the workshop it is even more difficult to visualize.

A further breakdown of this drawing would be needed

New Drawing Procedures to...

Increase Your Drafting Production

PART I—PHYSICAL EFFICIENCY

By ROBERT KERN
London, Great Britain

Beginning, a 4-part series on how to do better and faster drafting work. A good engineering drawing should be clear to all users, and should be done quickly to not delay actual construction work. Mr. Kern draws on his years of experience in drafting and drafting experience to share with you the secrets of efficient drawing room methods.

FAST, efficient drawing work can put a new plant onstream ahead of schedule, an important factor where competition puts a premium on quick construction completion.

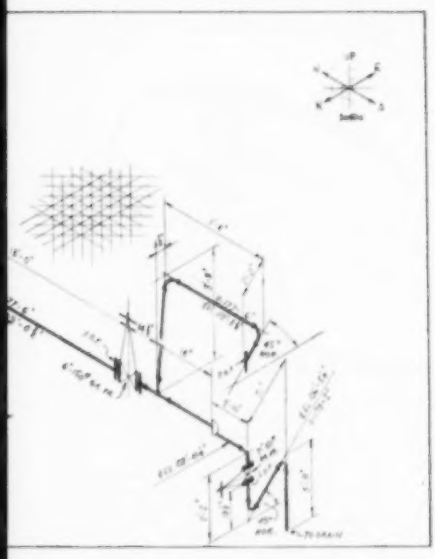
While the actual cost of drafting work is only a fraction of total plant cost, it directly affects related plant design work (purchasing, construction preparation and work). Time saved in drafting means money saved in onsite work.

A revamp or maintenance job which passes quickly through the drafting office stage can save days of onsite downtime.

Higher drawing production should not be expected from the designer's efforts alone. There should also be improved overall and departmental organization. An efficient organization makes the designer's work easier.

The man on the drawing board should also realize that constant self-criticism helps him organize his work to give better quality and quantity. This improved work makes him more valuable to his organization.

Though time and motion studies are not usually associated with a drawing office, an analytical approach to a designer's working methods will high-



Pipe Detail

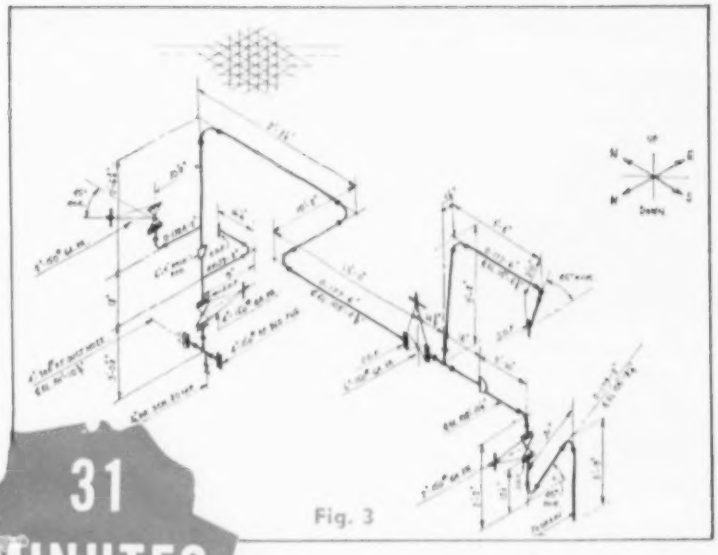


Fig. 3

31 MINUTES

Freehand Detail

Which Style is Yours?

before sending it for fabrication, thus causing more paper work and increased drawing time.

The single-line view in Fig. 2 not only is faster to draw than Fig. 1, but is more easily understood.

The free-hand drawing in Fig. 3 is another time saver, but the ability to present (and understand) such a drawing quickly depends also on mental capabilities. Valuable time can be saved by simplifying engineering drawing.

Four fundamentals of drawing production came from this experiment, and will be the subject of all four parts of this article. They are:

1—Physical efficiency of designers and draftsmen at work

2—Mental efficiency

3—The method of drawing presentation

4—Design coordination

---

light points to consider in planning for increased drawing production.

Ideal drawing office conditions seldom exist, and this lack will preclude adoption of some of this article's suggestions. Even so, unproductive time can be cut and drawing output per man increased successfully.

The two essential factors of efficient drawing production are speed and engineering accuracy. The thoughts of a well trained designer come faster than the interpretation of them through his hands. Therefore, by simplifying the activity of his hands, his mind can work more continuously and project his thoughts onto paper more quickly.

To have a good idea and a broken pencil is a dead loss. Often the idea gets hazy or is entirely lost by the time the pencil is sharpened.

Cutting "Overhead" Time

Several nonproductive and time-consuming operations are found when drafting work is analyzed. Cutting this "overhead" time allows more time for productive work.

Time spent away from the drawing board (except in mental work) is wasted production time. The following points will analyze the customary and the recommended ways of specific drawing operations.

A soft backing sheet of cardboard paper usually covers drawing boards. This backing sheet is used between the drawing board and the drawing paper. To get a dense line on drawing paper backed by this soft material requires a fairly soft pencil applied with a certain pressure. This gives an engraved line in the paper which is difficult to erase, and shows as a "shadow" line on a print.

The soft backing sheet also causes the pencil to "drag," necessitating frequent pencil resharpening.

A hard, plastic-treated backing sheet eliminates many difficulties. A harder grade of pencil can be used, needing less sharpening. Lines can be erased easily without marking the paper. Drawing speed is increased. This last statement is convincingly shown by first drawing a line on tracing paper backed with soft material, then drawing a line on tracing paper backed with a sheet of glass.

Good quality paper makes good quality drafting easier. Paper type also determines the grade of pencils best suited to it. It is advisable to experiment with several grades of pencil to find the best for a particular tracing paper.

For good reproduction, lines, notes and lettering need a certain density. Unfortunately, dense lines cause smudging and make a problem in keeping the paper clean. A spacer, 1/32 in. thick, under each end of the straight edge reduces contact with the paper and reduces smudging as the straight edge is moved over the paper.

Smudging can be avoided also by covering the completed area of the drawing, and by lifting the set squares and straight edge when they are moved

These Tools and Techniques Can Help You Boost Drawing

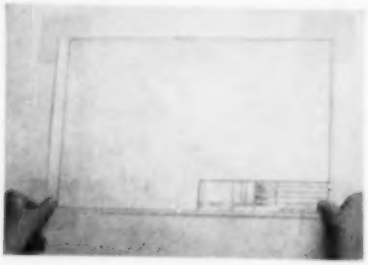
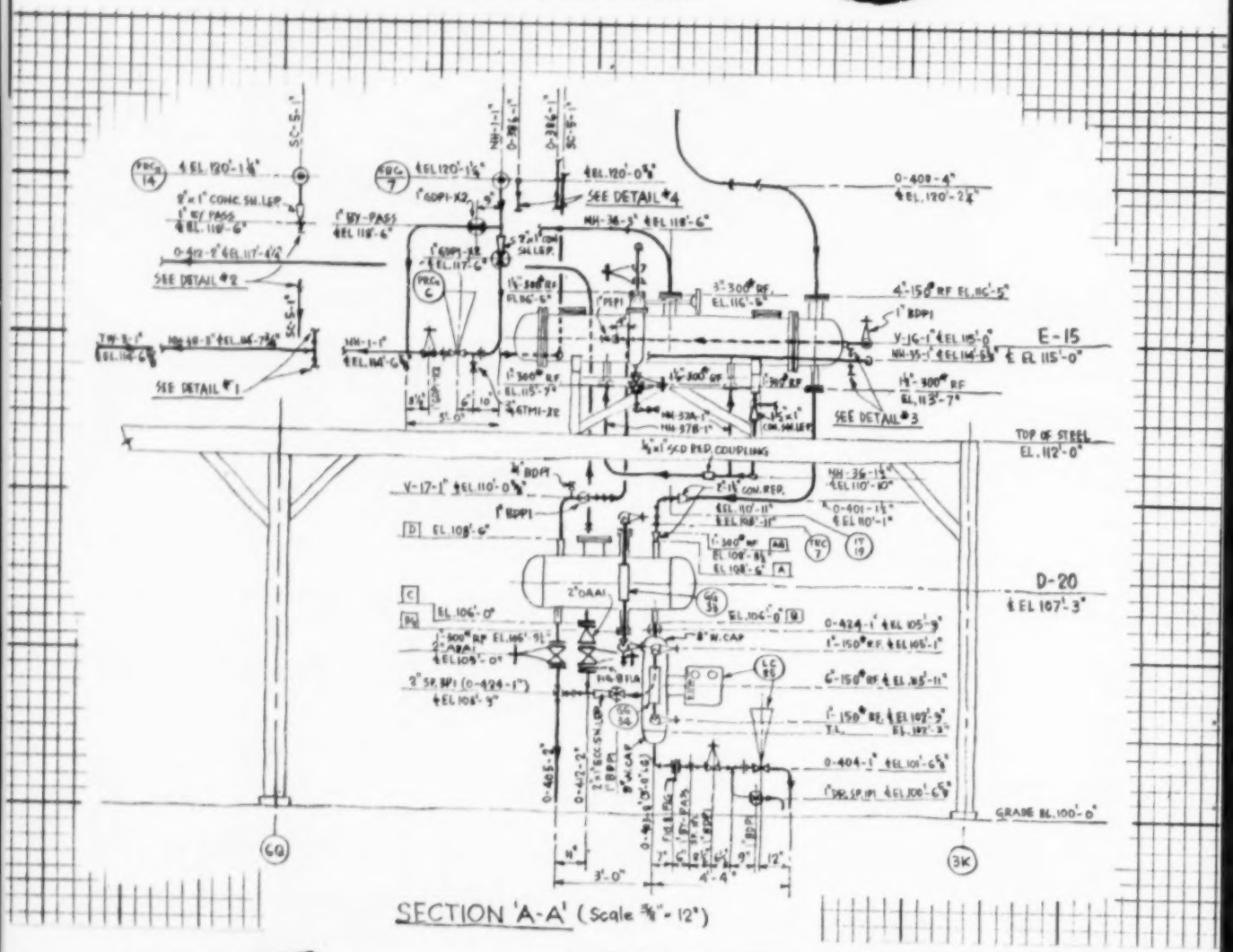


Fig. 4—**GUMMED LABELS** hold tracing paper, do not obstruct drawing instruments and save time in fixing and removing tracing paper

Keep reference drawing in front of you



Use plastic hard baseboard

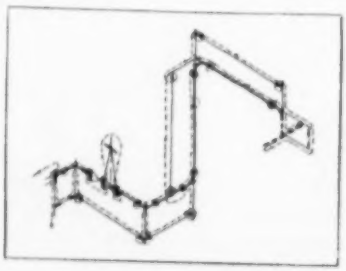


Fig. 10—**"LOCUS" OF PENCIL POINT** when making freehand drawing is shown by the dotted line

Fig. 5—**AUTOMATIC PENCILS,** push button type, save time, are sharpened quickly

Fig. 6—**"FOUNTAIN" DRAWING PENS** save much refilling time if ink drawings must be made

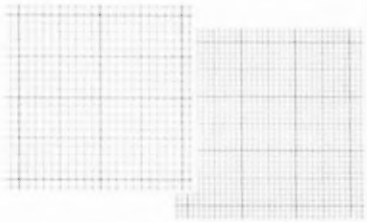
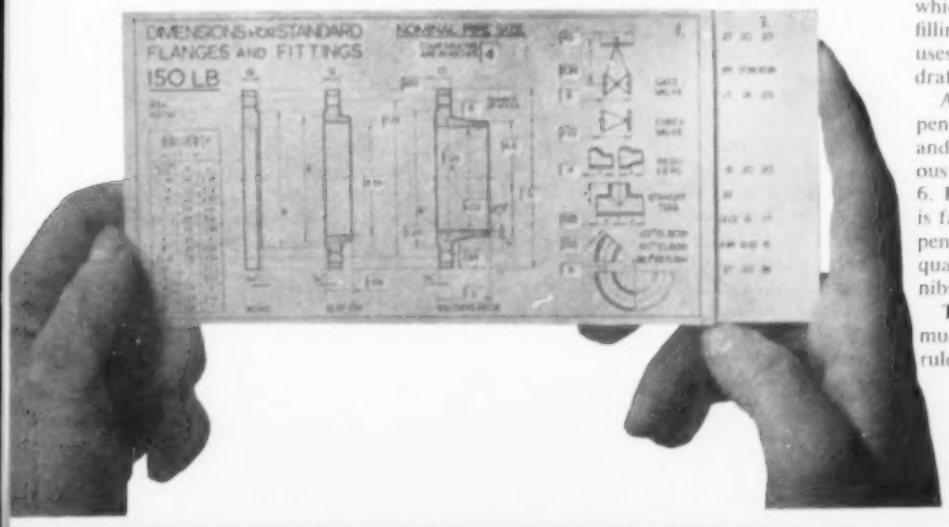


Fig. 7—**REGULAR GRID** on tracing paper speeds drawing and helps in making freehand lines

Fig. 8—**NIBS** for pen pen above, come in different sizes, are removable

Fig. 9—**SLIDE CHARTS SPEED DATA COLLECTION** over the use of catalogue references. The illustrated slide chart gives essential information about valves and fittings for nominal pipe sizes in 150 and 300 lb series



during drafting work. Here, some speed is sacrificed for the sake of a clean drawing. The problem of cleanliness is less for ink drawings, as they can be cleaned quickly by washing the drawing surface with cotton wool well moistened in gasoline or light spirit.

Fixing drawings with pins or adhesive tape is not a great time consumer, but can become tedious when minor revisions must be made to a large number of drawings.

A novel, trouble-free method of fixing a drawing is shown in Fig. 4. This device consists of a piece of linen paper about 3 in. square, gummed on the underside, and with a $\frac{1}{2}$-in. diameter hole in the center. The hole is covered by a piece of transparent adhesive tape with the sticky side uppermost.

After moistening the gummed surface, one of these labels can be fastened to the backing sheet under each corner of the drawing paper. By matching the top edge or margin line of the paper with a line drawn on the backing sheet parallel to the straight edge, the drawing can be fixed by applying slight pressure to the paper at the four corners.

Removal of tracing paper is then a simple matter of peeling off the drawing paper. A further advantage of this method of fixing drawings is that there are no annoying obstacles to impede the smooth travel of the straight edge set squares.

The ordinary lead pencil often proves to be a time-consuming and hand-soiling item because of its frequent need for sharpening. Push-button automatic pencils (such as shown in Fig. 5) can be repointed with a sandpaper block and are therefore better for drawing purposes.

Several of these push button pencils, all loaded with the same grade lead and all sharpened at the same time, speed drawing production.

Ink drawings are more time consuming than pencil drawings, but are often needed for printing reproductions or for illustrations. The length of line which can be drawn with one pen filling is moderate, and filling often uses as much time as the actual drafting.

A commercially available drawing pen, which works as a fountain pen and has interchangable nibs for various line thicknesses, is shown in Fig. 6. Known as the "Graphos," this pen is far superior to the ordinary drawing pen as regards the drawing time and quality of the ink drawing. The pen nibs are also illustrated in Fig. 8.

The use of scale rules consumes much time. For one drawing, a scale rule will be picked up and put down

hundreds of times, and time is wasted finding the desired scale on the rule.

Scale rules can be eliminated completely in drawing work by using "scale diagram paper" as shown in Fig. 7 (with ⅛-in. squares, every 10th vertical and horizontal line heavy), or the plastic treated backing paper can be printed with this grid.

Drawings can be made to scales of 1/16 in., ⅛ in., ¼ in. and ½ in. to the foot without a scale rule when using the scale diagram paper. Guide lines are readily provided, dimensions can be set, proportions appreciated, etc. Pipe spacings, pipe supports, steel structures, building outlines, etc., are easily arranged. Generally this graph paper can be used in all sections of design engineering.

The guide line system can be further elaborated by preprinting faint horizontal, vertical, isometric or perspective guide lines on the standard drawing paper. These lines do not appear on the print when the drawing is reproduced.

Freehand drawing can reduce the time which would have been consumed by using straight edges, set squares, compasses, etc. However, so many organizations and individuals frown on such a drastic measure, drawing instruments will still be used.

Even so, the number of mechanical aids can be reduced by careful choice of the right instrument type. For instance, one adjustable set square is better than two standard set squares (45° and 30°). The adjustable set square also eliminates the need for a separate protractor.

Work can be simplified by using transparent (preferably brightly colored for easy finding) templets for drawing radii, ellipses and various standard symbols.

The freehand drawing can be used to advantage for drawings not needing "polish" because of their purpose or simplicity.

A proper technique is needed for efficient freehand drawing. Lines should be drawn continuously and with as little movement of the hand as possible. In Fig. 10, the thin dotted line shows the "locus" of the pencil point when producing a freehand drawing.

The pencil should not be lifted from the paper unnecessarily. A good rule is: Never turn back once a line has been drawn. Many draftsmen go over a line several times when drawing a freehand, or even a ruled line. Good freehand drawing requires a mental attitude where the mind is one step ahead of the pencil point.

There are limitations to freehand drawing, depending upon the draftsman's ability. Usually a practical balance can be found between freehand and "orthodox" drawing by confining freehand work to the smaller details of a drawing, and using set and T-squares for the longer lines.

Reference to catalogs about numerous manufactured items is made during preparation of both layout and detail drawings. Much time is used in thumbing through pages, columns and lines of engineering data.

Slide charts can eliminate much of the time used in catalog work. For example, Fig. 9 shows a slide chart designed to give all essential information about valves and pipe fittings that a piping designer or detailer needs. This slide chart shows quickly and clearly, in one well-organized picture, dimensions of the most commonly used valves and fittings for any nominal pipe size.

One side of the chart gives data for 150 lb flanges, fittings and valves, while the other side covers the same items in the 300 lb series. Thus, one setting of the slide gives information that is scattered in several catalog pages. Similar quick-reference charts can be designed for other standard items or pieces of equipment.

Company design practices, standards and specifications (bound and indexed) give another handy and compact source of information. Placing these in a special holder under one corner of the drawing board, within easy reach, eliminates unnecessary trips to the reference table.

Instruments and reference information should be easily accessible from the drawing board. Physical tiredness results from much tramping about for tools and information, and leads to slower mental work and a decrease in drawing production.

Reference drawings are a "must" in engineering work, but a busy designer floundering in a sea of reference drawings seeking an elusive piece of information consumes much time.

Providing a means of fixing a small, or suitably folded large, drawing, at the top of the drawing board places the information before the designer's eyes, making reference easier and quicker.

Where large drawing boards are used, the top section of the board can be used for fixing and supporting reference drawings.

Applying the Suggestions

The suggestions made in this article are summarized and demonstrated on the preceding two pages. Included in the large figure is freehand drawing, which should convince the critic who limits freehand drawing solely to simple sketches. Quite complicated and involved drawings can be presented in this way.

Obviously, certain assumptions have to be made when considering the use of freehand drawing to improve production efficiency. The first is the utmost attention is paid to the smallest detail connected with drawing activities. The second is the draftsman should develop a good aptitude for freehand work. The choice of the right scale, good proportioning of the drawing itself, and the location of dimensions and notes all enhance freehand drawing presentation. The third assumption is that of constant self-criticism by the draftsman, and a realization of his own strong and weak points.

The hardest part of freehand drawing to the conventional draftsman is the decision to adopt the freehand technique. Nothing can be forced, but an intelligent approach will soon bring profitable results. The ability to sketch alternative designs quickly, and to compare them on paper is a valuable asset. No idea will then be lost and the full scope of the designer's ideas will be better developed.

An open minded appraisal, and recognition that the biggest handicap in a good designer's output is the slowness of conservative drawing methods, can yield worthy production dividends.

Next month, Mr. Kern tells how to increase drawing production by improving the mental outlook of designers engaged in the over-all and detail design of oil refineries and chemical plants.

Meet the Author

Mr. Kern

Mr. Robert Kern was born and educated in Budapest, Hungary. After matriculation and a year of practical engineering work, he studied mechanical engineering at the Royal Joseph Technical University, obtaining his "Dipl. Ing." degree in 1946. Mr. Kern's first job in industry was in power plant design. He left Hungary in 1948 for England and there he joined the Kellogg International Corp. (subsidiary of M. W. Kellogg Co.) He has been with Kellogg since 1949 as layout and planning engineer.

PETROLEUM PROCESSING brought a tape recorder to the last regional meeting of the Western Petroleum Refiners Ass'n in El Dorado, Ark., and came away with enough valuable tips to provide a series of articles on solving processing problems. Source of information is the panel of authorities that took on all questions at an all-day question-and-answer session during the meeting. This is the third part of the series. For list of panel members, see box on p. 87.

Eleven technologists and a recorder help you solve

Octane Improvement Problems

Wheeler: We are now ready for a hot question—octanes. I'm sure that everybody is interested in octanes because they only go one way—and that's up. We have a number of questions here on octane—it's sort of a general subject such as, first, how to make them, and what's the most economical way; something about lead; and it looks like some day we are going to be forced into the isomerization of normal paraffins and we'll get into that. Bob Maddox, of Blaw-Knox, will start this off!

Wheeler

? What is the general octane situation?

Maddox: At present, I doubt if anyone is making higher octane material than is actually required. When setting up your plant operations, of course, you have a marketing consideration; also, the type of crude being processed has a great effect on the methods used and the results which you eventually acquire.

Maddox

At the moment, we are looking at catalytic reforming from 95 to 100 octane, and various methods now by which such material can be made. We have Rexforming—or a combination of catalytic reforming at lower severity, and extraction of aromatics. Also, we have known processing methods of reforming at higher severities with regeneration of the catalyst. In addition, Houdry has recently published an article called "Iso-Plus" in which they suggest several methods of reaching these higher octanes. In one they combine both catalytic reforming and thermal reforming.

Now beyond that, people are beginning to wonder—what do we do next? I'm sure we all agree that it looks as if we approaching an octane limit, as far as catalytic reforming is concerned directly. Let's look at the practical side of the problem and consider what we are trying to accomplish.

Actually, catalytic reforming is a process to change naphthenes to aromatics. First of all, it is most desirable to accomplish *that* basic purpose. Beyond that, the manufacture of these higher octanes by alternate methods are simply means of converting normal paraffins to some other type of higher octane material. Whether you lay down coke, operate at lower severities and recycle, these methods are all means of converting the normal paraffins to higher octane product.

The one important single component that degrades gasoline is the normal pentane content. The next step in processing of gasolines may be to take normal pentane and isomerize it. Certainly isomerization of pentanes will improve the resulting octane material we now have available.

Licensors are about ready to present the refiners with specific pentane isomerization plans—and I should imagine that these plans would be somewhat similar in design to those experienced with catalytic reformers. There are certain advantages in using a type plant such as outlined for catalytic reforming. It is easier to maintain and operate than an isomerization process using aluminum chloride catalyst.

■ Tips on Octane Improvement

Looking back at some of the panel questions, we can ask, "What route do we take? Do we catalytically crack? Raise the severity of catalytic operations? Do we put in more reforming or perhaps reform at higher severity?"

I would say, expect to go to about 70 to 75% conversion on a catalytic cracking unit. Then catalytic reform at lower severity and do something with the normal pentanes.

Beyond that, everybody is becoming interested in alkylation. There is one distinct advantage in blending alkylate to improve the octane of the gasoline. It increases the motor octane, an important factor in meeting present-day higher octane requirement.

We are just about at a new era in refining processing. There are many special tools, each for a particular job, and all must be utilized effectively. Run cat crackers at higher conversion levels of 70 to 75%, reforming at lower severities, isomerize normal pentanes, also look forward to alkylation.

Wheeler: Thanks a lot, Bob.Does anyone else on the panel have anything to say about these problems? Do we have a process for isomerizing, or is someone working on it?

? Has the isomerization of normal paraffins over platinum catalyst reached the point of commercial development? If such a process has not reached commercial development stage, when is it anticipated to be at such a stage of development?

Walter

Walter: We do have one plant in operation which was designed to combine isomerization of normal pentane with catalytic reforming. Because of the refinery balance situation, it is not actually operating that way, but is perfectly capable of doing it. You can simultaneously produce iso-pentane and Platformate. From the standpoint of separate isomerization, that is of course perfectly feasible too, commercially.

Wheeler: Let me ask a question, Jack. Does the presence of these other materials, the aromatics, naphthenes, etc., in the reactor, change the equilibrium in the isomerization of the lighter paraffins?

Walter: It does not change the equilibrium but there does seem to be an advantage, in terms of conversion per pass, in carrying out the operation separately. In other words, separate isomerization of pentanes will result in higher conversion to iso-pentane per pass than is achieved in combined operations.

? Wheeler: Is the isomerization-reforming process applicable to hexanes and heptanes also?

Walter: That, of course, is the crux of the problem in the fractionation—the separation of the isomers. I suppose we all would like to see an inexpensive method for separating isomers from complex mixtures with normal hydrocarbons.

Womeldorph

Womeldorph: The only thing I wanted to clear up is our Iso-Plus processing scheme. We have three schemes. The first is a combination of catalytic reforming and thermal reforming, and the second is actually set up as two separate cases. One, where we use an extractive type of unit to remove the aromatics and then recycle the paraffins back to the original reformer, and in the second case we use a separate reformer for this recycle material.

Wheeler: I would like to make one comment that came up this morning that I thought was very interesting. It looks like octanes are going up so high that pretty soon we're all going to start putting our cat-cracked gasoline into regular grade gasoline. The only way you can make the necessary high octanes for premium is by catalytic reforming.

There are two dogs in the refinery, from an octane standpoint, called coker and thermal gasoline, and they are very difficult to handle. They have very low octane and a detrimental effect on pool octane. It was suggested that it was probably a good idea to charge such stock, particularly the coker gasoline, to your cat cracker, when you are using the cat cracker to make regular gasoline. This is because it would probably be cheaper to reform this coker naphtha, desulfurize it, and raise its octane by that procedure, than it would be to desulfurize it and charge it to a catalytic reformer.

Now, are there any comments or questions from the floor. Not on whether the octanes are going up or not, but how we're going to get them.

? Is there anything being done, not particularly by industry, to raise the maximum TEL level in motor gasoline?

Wheeler: If we have any Ethyl or Du Pont men aboard, I wonder if they can tell us of any work that they, or the Surgeon General's office, are doing to raise lead content?

Waitz (Du Pont): No, because first: above 3 cc it would be a tough job to get the Surgeon General's office to make that change, and second: the response to lead levels over 3 cc is not very good. As a result, raising it to 4 or above wouldn't prove to be very economical anyway.

? Which is the most economical operation on a cat cracker — using cracking severities or TEL on gasoline?

Maddox: That's one specific question asked here that was not covered. The answer depends on what level you are talking about. If you are talking about operating at lower severity and currently down to a conversion, say of about 50%—then probably it would be more economical to raise the severity. But if you are up to the higher conversion levels, say 70%, then you should add more lead to meet octane requirements.

Wheeler: Are there any other comments or questions?

Womeldorph: I think the octane that you get on cat-cracked gasoline is pretty much a function of temperature in our reactor, rather than severity or conversion.

Wheeler: This next subject is alkylation, and by reviewing the questions, I'm sure you can see that the folks who have sulfuric plants are the ones that have the problems. As long as you have an HF plant as we do, apparently there are no problems.

Questions This Month Include

- Isomerization of Paraffins
- Cracking Severities vs TEL
- Sulfuric Acid Alkylation
- Acid Neutralization
- Corrosion and Graphitization

? What has been the acid consumption of sulfuric acid alkylation plants of the Kellogg-Cascade design when charging a B-B feed? Also, when charging a P-P feed?

Banta

Banta: In answer to the first question, I will say that we do not have a true single cascade Kellogg system. We have two Stratco reactors which operate in parallel. Then, following these two reactors we have a Kellogg cascade reactor. The effluent from the Stratco reactors goes into the Kellogg system, and additional olefin is added into each of the three mixing stages in the Kellogg reactor. We made a test run initially on the units over a period of about two weeks and we came up with an acid consumption of 0.584, which I think is a very good figure. We have no experience on P-P feed, maybe others in the audience will give some comment on that.

? What effect does the iso-butane to olefin ratio have on acid consumption?

Banta: From our experience there is some variance in the iso-butane to olefin ratio in which we don't get an apparent influence on acid consumption. I would say possibly in the range of 6 to 9 iso-butane to olefin. As far as our going to a lower iso-butane to olefin ratio, that is only an accidental experience. Our experience has been that you do increase acid consumption at the low ratios. But, as for practicing the low iso-olefin ratio, that's just out.

? In alkylation unit refrigeration systems when alkylating C_4, only how is propane removed from the refrigeration recycle?

Banta: Our Kellogg reactor has an auto-refrigeration system. The initial design of the unit called for propane removal by depropanizing a slip stream off the condensate drum on the refrigerating recycle. We ran into some difficulties on that problem. There was, apparently, enough acidity in the refrigeration condensate stream that went into the depropanizing system. Because of the small amounts of moisture that were apparently picked up, we experienced very severe corrosion of the water drawoff nipple in the depropanizer reflux drum. In fact, we got into a pretty serious scare on that, because of the unpredictable rate of corrosion. So, that particular problem really leads to the next questions. In fact I might say that these are my questions, so I will answer them in the light of our own experience, but I will certainly welcome any comments or discussion from the floor.

? In sulfuric acid alkylation what is corrosion experience in lines and pumps handling the reactor effluent following caustic and water washing of the stream? And . . .

? Has anyone experienced graphitization of cast iron pump parts? What steps have been taken to correct corrosion experience? And . . .

? In sulfuric acid alkylation, what has been corrosion experience in depropanizer systems charging condensate from an auto-refrigeration system similar to the Kellogg design?

Banta: In our particular problem, instead of attempting to remove propane from the refrigeration effluent stream, we permitted the propane to go on out with the total reactor effluent and picked up a slip stream off the de-isobutanizer. Fortunately our propane content was quite low and we have been able to keep the propane level down to a point where we don't get into difficulty. However, it is necessary periodically to vent the condensate drum on the refrigeration system. When we discussed the problem with Max Moody, he commented, I believe, that in one of their designs they actually do vent the refrigeration condensate drum into a low pressure system. He may care to enlarge on that comment a little further.

We have experienced corrosion following caustic washing of the reactor effluent in our transfer pump from the water wash drum to the de-isobutanizer stripper. In our alkylation system, the total reactor effluent stream, after caustic and water washing, is charged to the de-isobutanizer stripper. There the iso-butanes are removed, then the bottoms from the de-isobutanizer go to normal butane separation.

Then, of course, the alkylate stream is separated into light and heavy alkylate in the rerun tower. The transfer pump from the water-wash drum to the iso-butanizer tower had a cast iron impeller and cast iron wearing rings. Under certain operating conditions which we haven't been able to specifically isolate, we had very severe graphitization of the cast iron components. In fact a pump may graphitize severely to the point where the clearance between the wearing rings will reduce the pump efficiency so it will not transfer the material, say maybe within a week's time.

As yet, we haven't solved the problem. We are thinking possibly of going to high-chrome impeller parts. However, some people in our organization feel that we should correct the problem basically, and basically means to correct the reasons for the corrosive products which are apparently affecting the pump. I imagine it's probably a result of the weak acids.

■ Tips on Octane Improvement

It's been rather interesting to note that on testing a sample of the material leaving the caustic wash drum, it will be alkaline. If you let it stand for 24 hrs., it will show a slight acidity. Apparently there is some decomposition of the alkyl sulfur compounds.

? In removing all acid from alkylation reactors for complete cleanouts, what methods are used to neutralize the last remnants of acid? Are alkalies circulated prior to unheading?

Banta: In our particular experience in readying vessels, that is, acid reactors or contractors, the vessels are emptied either by pumping out or gas-pressuring out. We actually gas pressure the hydrocarbon and acid out of the Stratco system. We then give the system a good heavy water wash with the impellers rotating. Following that, the water is drained out.

Then the system is refilled again with water, while caustic is added. The system is agitated with the weak caustic solution; we make sure that it maintains its causticity over a period of at least 20 minutes. That is our method of being sure that the final remnants of acid are completely neutralized in the reactor before proceeding with the further work of readying the vessel for entry.

Wheeler: Fine, Norm, thanks a lot. Max, on your operations here in El Dorado, could you give us different answers, or more comprehensive answers on some of these problems?

Moody

Moody: I might say that on the isobutane-to-olefin ratio problem, I think you certainly will have more acid consumption and will certainly make a low quality alkylate. In bleeding off our refrigeration system, we do use the vapor phase off the top of our drum and give it a caustic wash before it goes back to the system. The only place that we are having a corrosion problem, after the caustic wash, I believe, is our de-isobutanizer feed preheater. We do have tube troubles there, and we are going to 18-8 tubes.

Wheeler: Does anybody else on the panel have anything to say about sulfuric acid alkylation? What about comments from the floor?

? Turnbull (Cities Service): When you experience corrosion in your stabilization system, using part of the charge condensate from the refrigeration drum, where does the water come from that gives you the corrosion problem?

Banta: Well, we would like to know that too, frankly. We know the water is there because we may get a cup full a day, or every two or three days. That's the only stream that's going in. Of course, there's another thing that accentuated the problem: we had difficulty after a month or so operation, and then, following that, the tower had to be taken out of service. In that process we shut down, depressured and steamed out the tower. In so doing, we introduced water into the system right away.

Part of our initial difficulty may have been associated with water in the system, that's the depropanizer system, before putting it on the line. We have thought possibly that in coming on line, if we would fill the system and operate it on condensate from the de-isobutanizer, which would be iso-butane, that the system would be sufficiently dehydrated. But even that apparently carried enough moisture.

We have attempted to run some tests on moisture content of the hydrocarbon stream. That's the iso-butane stream, and I certainly would be interested if somebody has a method that could be relied upon to mean something in determining that water. We use the Karl Fischer method, and we get some figures, but we don't believe them. I think most recently, the *Oil & Gas Journal* carried an article by the Stratco people on a plant built for The Texas Co. at El Paso. Their design calls for taking a stream from the refrigeration system and depropanizing it to remove propane. Apparently it must work, but I would certainly be interested in hearing some experience from those people.

? What effect does mercaptan content have on octane yields, acid consumption, etc., when present in feed to a sulfuric acid alkylation plant?

Wheeler: Do we have any experts on that?

Curran: I feel that the mercaptan content affects acid consumption mole for mole. Each mole of mercaptan will consume one mole of sulfuric acid. I do not have any information, however, on what effect it would have on octane.

? In this corrosion experience that Pure is having on its pumps, pumping the water-washed effluent into the first fractionating tower, why don't they pump the acid-containing stream, before treatment, to get away from that problem?

Banta: Well, in our particular design we do pump the acid stream into the caustic wash system. Our reactor effluent pressure is in the neighborhood of 15 psi. We transfer into a caustic wash drum, with a mixing device ahead of it, and following that, the stream then goes at the pump discharge pressure into the water wash drum and, of course, we have a circulating water stream, then also a water separating partition in that one single drum. We then pick up that washed stream and transfer it into the de-isobutanizer.

You've lost too much pressure to eliminate the pump?

Banta: Yes, we've lost too much pressure through the system. The basic design on the original system was such that caustic wash and the water wash facilities wouldn't stand the pressure that is required to operate the de-isobutanizer.

Another thing too, this particular arrangement permits us to use the water wash drum as a surge vessel to maintain constant rates to the de-isobutanizer, which is quite important, as you all know. We do not have any corrosion problems in the rerun tower.

About the Panel

THE all-day question-and-answer session is a regular, and popular, part of WPRA's annual regional meeting.

The 10-man panel replies to prepared questions, then answers questions from the floor.

The group of five refinery men and five engineering men was directed and moderated by Harry K. Wheeler, Pan-Am Southern Corp., El Dorado.

The refiners were: N. S. Banta, Pure Oil Co., Nederland, Tex.; E. A. Heike, Premier Oil Refining Co., Ft. Worth, Tex.; L. K. Buchanan, Bell Oil & Gas Co., Ardmore, Okla.; M. S. Moody, Lion Oil Co., El Dorado; and O. A. Fuchs, Pan-Am Southern Corp., El Dorado.

The engineering panel: R. R. Maddox, Blaw-Knox Engrg. Co Philadelphia, Pa.; J. S. Clarke, Esso Research & Engrg. Co., Linden, N. J.; D. F. Ferguson, The Refinery Engrg. Co., Tulsa, Okla.; J. F. Walter, Universal Oil Products Co., Des Plaines, Ill.; and D. E. Womeldorph, Houdry Process Corp., Philadelphia, Pa.

There is one interesting basic premise that was made on the design of our system. I might say that in the initial Lummus design which used Stratco contractors, we operated the re-run system with a hot oil circulating belt running 600°F. oil temperature to the reboiler. In the re-design, we utilized no oil heat on the re-running operation. The maximum temperature at any place in the re-run system was set at 340°F. We operate the re-run system at the minimum possible pressure. In fact, we would like to operate the overhead condenser at vacuum or even less if we could maintain it.

So, we feel that with the lower the operating temperature on the re-running operation, the less trouble there will be with the reboiler fouling. Now apparently, corrosion must be associated with the decomposition of the alkyl sulfates which must still remain in the heavy alkylate. I think we've eliminated, or don't have corrosion problems, especially because we operate at low temperatures. We have no reboiler fouling problems at all.

Wheeler: How about some more questions on sulfuric acid circulation? It appears everybody has a different problem.

? Riggs (D-X Sunray): Has anybody found a good bolting material for acid lines in an HF Alkylation plant? We have used both K-Monel and B7 in this service and apparently neither has proved completely satisfactory.

Wright (Pan-Am Southern): The answer to that is, if you don't want to have leaky flanges, use ring type joints. If you do use screwed connections, we find "Best-o-Life" lead seal will assist in making up a tight joint.

? Comment: We have a problem in our sulfuric acid plant with water in the isobutane recycle, and we are currently using coalescers to remove this water, and wondered: has anybody come up with anything more efficient?

Banta: We are not currently faced with a problem of that type. I might ask, is there any moisture coming in with the outside iso-butane stream coming into the system?

I'm not sure; we just know we have water in the iso recycle.

Banta: That apparently resolves itself like that problem we had on the depropanizer. You would think that the recycle streams shouldn't have any moisture. Now if they had moisture, maybe that adds a little credence to the problem I had on the depropanizer, in getting moisture into the depropanizer. We have in our particular operation a large iso-butane reflux drum. Following that, the charge combines with the olefins into a second large drum. So we have the advantage of two large vessels that can serve as settlers and we do draw some water on the second drum. We don't feel that we have a problem on moisture. However, I'm sure that if you could make the incoming streams absolutely dry, you could reduce acid consumption.

Whiting (Ingersoll-Rand): I don't have an answer, but I do have a suggestion for Mr. Banta in regard to the pump that is graphitizing. For the last couple of years Ingersoll-Rand has made a material to prevent graphitizing in certain operations. Whether it will do it for you or not, without knowing more about it, I don't know. It's called nodular iron or ductile iron. It has all the metallurgical characteristics of cast steel, but it is an iron. The reason it resists graphitization is this: the graphite flakes are no longer flat, and knife-like. Therefore, as your corrosion starts, it wipes out the carbon and leaves the graphite exposed, which liquid velocity wipes off. Nodular iron is in little circular spheres, which have no point of contact to begin. It is possible that you can get an impeller and wear rings made of that material. The casing of your pump is not giving you much trouble, is it?

Banta: No, we are getting some corrosion, but it isn't a serious problem.

Whiting: Well, your high velocities are in your impeller, that's why you keep sloughing off the graphite. When you get home, ask your pump manufacturer for that material. Possibly you can get out of it without too much cost.

Next Month's Topic . . .

Coking . . .

with these subjects discussed: Reducing carbon in coke gas oil, Optimum carbon residue, Proper time cycle, Effects of pressure, Anti-foam agents

G. H. Hemmen, chief engr. research center, and **H. R. Emmerson,** commercial development div., Union Oil Co. of California, Brea, Calif.

George Grimes, supt., Cosden Petroleum Corp., Big Spring, Tex., and **Tom Lumly,** pres., Refinery Engineering Co., Tulsa, Okla.

Refiners Rendezvous at Montreal

HERE ARE informal snaphots of men you know, taken by the PETROLEUM PROCESSING photographer during the Montreal meeting of the American Petroleum Institute Division of Refining, May 13-15, at the Sheraton-Mt. Royal Hotel.

Glenn Wilson, sect. head, tech. service, Humble Oil & Refining Co., Baytown, Tex., and **Bob Phillips,** Howe-Baker Co., Houston, Tex.

A. G. Stewart, mgr., Imperial Oil Co., Ioco, B. C.; **W. L. Banks,** Houston, and **A. W. Bennett,** Toronto, both sales, Davison Chemical Co.

Hal Shockley, vice pres., Gibson Petroleum Co., Calgary, Alta.; **J. A. Nevison,** licensing sect., Atlantic Refining, Phila.; and **Bob Barnhill,** mgr., British-American, Calgary

D. G. Debo, supt. mech. div., Standard Oil Co. (Indiana), Whiting; and **C. F. Ebsen,** mgr. New York sales, Foster Wheeler Corp.

James P. Shambaugh, mgr. process promotion div., Socony Mobil Oil Co., and **C. W. Saacke,** pres., Commonwealth Oil Refining Co., Boston, Mass.

T. M. Mixon, supt. mech. engrg., Ethyl Corp., Baton Rouge, La.; and **Martin Michaud,** materials engr., Union Oil Co. of California, Los Angeles

R. W. Richardson, sales mgr., Phila., Ethyl Corp.; and **Hugh W. Field,** vice pres. and mgr. res. and development, Atlantic Refining Co., Phila.

J. E. Fenex, mgr. refg. Rocky Mt. region, Denver; and **C. D. Hull,** mgr., Ponca City, Okla., both of Continental Oil Co.

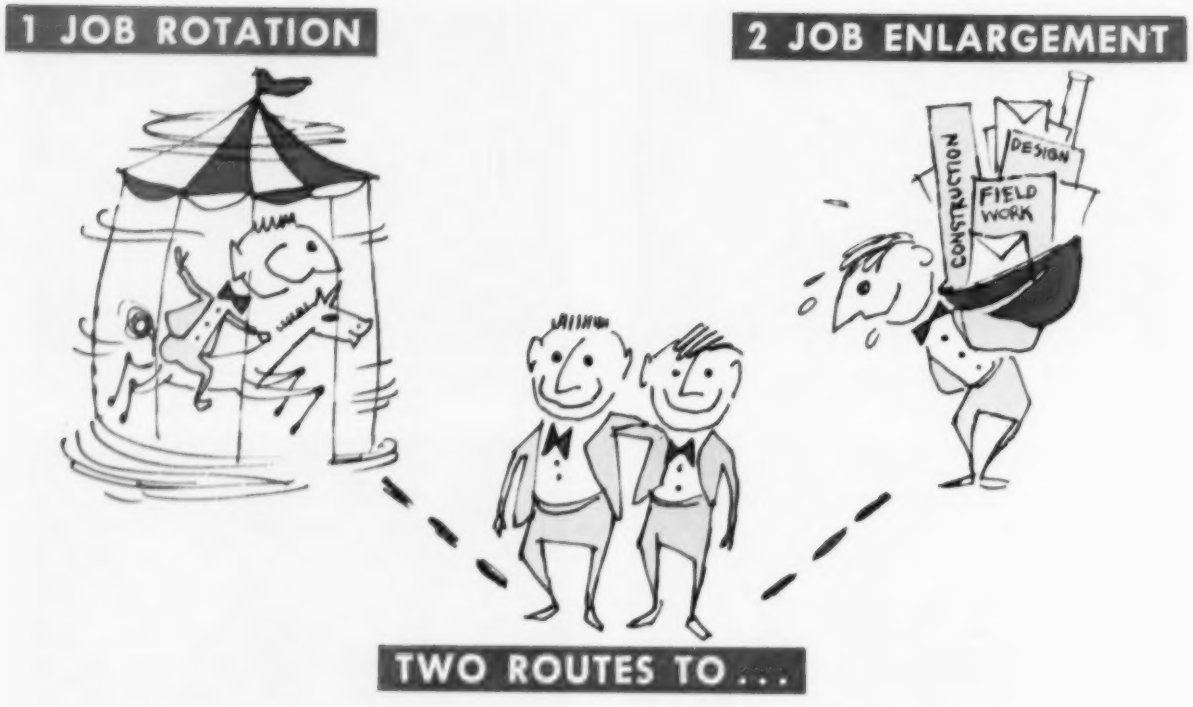
Harvey Blankenship, director of advtg., Universal Oil Products Co., Des Plaines, Ill.; **Tom Leech,** sales mgr., Petro-Chem Development Co., New York

Bill Badger, Petreco, Phila.; **Wesley Hoge,** mgr. engrg., Houdry Process Corp., Phila.; and **Geo. Myers,** supt., Ashland Oil & Refining Co., Catlettsburg, Ky.

L. F. Strader, asst. to vice pres.; **David E. Day,** vice pres. mfg.; and **C. A. Day,** mgr. of research; all of Richfield Oil Corp., Los Angeles, Calif.

Geo. Mateer, vice pres., Cities Service Refg. Co., Lake Charles, La.; **Lee Haugen,** vice pres., Cit-Con Corp., Lake Charles; **D. R. Johnson,** mgr. of refg., Continental Oil Co., Houston, Texas

R. G. Sanders, asst. mgr. refg., Magnolia Petroleum Co., Beaumont, Tex.; **C. T. Draney,** vice pres., Bechtel Corp., San Francisco; **R. R. Jackson,** genl. mgr. of refg., Socony Mobil, New York



Better Job Performance

Take the high or the low road, both lead to major benefits

By JOE R. FULLER
Creole Petroleum Corp.

SOME new answers to old problems are emerging from the oil industry's growing interest in two management techniques: Job Rotation and Job Enlargement. By rotating a man among several different jobs over the years, or by actually enlarging the scope of his work, some forward-looking managements feel these benefits are possible:

- **A better satisfied employe,** a fact that shows up in fewer absences, lower turnover, and fewer grievances.
- **Better development** of supervisors, in line with current thinking of management specialists.
- **Higher skill levels** among employes, a mounting concern wherever automation is bringing major changes.

Several of us from industry made a year-long study of these techniques while at Harvard Graduate School of Business Administration. We interviewed a large number of people, from vice-presidents to wage workers. Here are some conclusions we reached.

These methods may be used for any job within a company, with a few exceptions. The unit operator and the field or shop maintenance man can be given varied assignments, or enlarged responsibilities, with beneficial results.

Office workers—machine operators, secretaries, file clerks and others—will respond quickly to management's interest in their jobs. Experiments in some of the large insurance and utility companies have shown that varying or enlarging these jobs will often increase output.

While the benefits with those doing routine work are demonstrable, oil company management will probably get the best results from these techniques with technical and supervisory personnel.

What Is Job Enlargement?

In the engineering department of a refining company operating in the central U. S., two or more men used to handle the design and construction of a small project. One would design, and then either he or a second man would estimate costs. Next, the design would be sent to the field, where another engineer handled the construction. Some jobs were even further divided. This is a common arrangement at refineries even now.

Today one man generally does all the work on a small project, first executing the design and then looking after the actual construction. This way, he acquires both inside and outside experience. His job has been enlarged.

Of course it takes longer to train a man fully for this job. But we have all seen the designer who hasn't the field experience to make a practical design, or the man in the field who can't give fast answers to field problems because he doesn't know enough about design. The company's new system solves much of this problem.

Engineers at the refinery are enthusiastic about the change, too. They enjoy carrying projects all the way through and feel they are getting twice as much experience as engineers working under the old system.

Furthermore, management at the refinery is helped when it wants to pro-

mote someone in the department. There are several men who know all phases of the work.

A Self-Starting Rotation

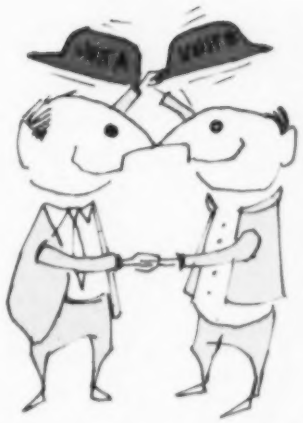
Awhile ago, supervisors of two big units at a petrochemical plant on the Texas Gulf coast took matters into their own hands. Each had lived with his own unit for quite a time and felt that he was in a rut. At the time, there were no upward promotions open; so they "promoted" themselves sideways —took each other's jobs.

Learning about the people and operations of the new units made their lives a little more interesting. It was a challenge. Also, they filled out their knowledge of overall plant operations —a benefit to management and themselves when promotions came up. This is how rotation has been used on an individual basis at a small plant.

At one of the larger refineries in the United States, job rotation is used as a matter of policy. Here supervisory personnel are included in the plan if they have two qualifications: (1) demonstrated competence in their present position and (2) promise of being able to handle the new job in a satisfactory way.

The experience of one man there is fairly typical. A young technical worker, he has held seven jobs in as many years. The jobs have been radically different from one another and each one has entailed more responsibility than the last. For instance, he has supervised an operating unit, recruited engineering personnel, scheduled product mixing, and headed up a foreman's training program. His morale is excellent, his opinion of the company high. Contrast this to the man who has had one job for 15 years and looks forward to only one thing —the day he retires 15 years hence.

". . . the designer who hasn't the field experience to make a practical design."



". . . the supervisors 'promoted' themselves sideways . . ."

What Can They Do for You?

Let's examine the benefits of job rotation and enlargement which were listed at the beginning.

1. Increased Job Satisfaction. This is a question of equal importance to employes and management. In many ways it's the most impressive gain that these innovations can offer. Ever since the Machine Age began, the worker's job has been shrinking in scope; he plays a smaller part in the complete operation and comprehends less of the whole. The assembly line is perhaps the ultimate example. But even in the refinery, some men have little more to do than turn a couple of valves when the operator in charge gives the word.

For some workers, it is true, the simpler the job and the less responsibility the better they like it. But others don't feel that way. They share the common human wish to be important, a necessary cog in the greater scheme of things. When their jobs have shrunk to turning a couple of valves in the refinery yard they are apt to turn their unused abilities and desire for recognition in other directions.

If routine jobs are enlarged to the point where a man is challenged in order to keep up, he will generally like his job better. Or he will often be stimulated by a change in jobs—even if they are on the same level of responsibility—and prefer it to continuing indefinitely on the same job.

The union insistence on giving senior employes first chance to bid on jobs in new units is an outgrowth of this desire for enlargement and change in status and surroundings.

The satisfaction that change and growth in a job can bring is justification enough for job rotation and job enlargement from the employe point of view. Management, which also has to worry about productivity and morale within the company, is thankful for any improvement in employe motivation.

2. Development of Supervisors. Petroleum processing is such a complex industry that it requires many specialists. Yet within the ranks of specialists there are men with management abilities who can be developed by a sound personnel policy. Giving them bigger jobs and exposing them to several different operations is one effective way to train these men. It is difficult for a man suddenly pushed in the management slot to do a good job if he has held nothing for years but non-supervisory jobs.

What's more, even with some of the highly specialized jobs a rotation policy can be effective. A man from a related field in many situations can be almost as good in a few months as his predecessor was after five or ten years. Where this is true, both men could profit from rotation.

In any case, young men who aspire to middle or top management jobs someday must be willing occasionally to lay aside their slide rules and learn more about operations as a whole. Company policy, however, must be flexible enough to offer both the technician and the potential executive opportunity for development and satisfaction.

3. Upgrading Employe Skills. Automation requires broader competence from employes.* This is true even in the oil industry, though here it is not a new trend. Everywhere, however, unskilled and semi-skilled workers are relatively less in demand than formerly. It is to broaden men to meet the ever-growing requirements of their

*See "Automation to Bring Big Changes in Industrial Management Concepts," Petroleum Processing, March, 1956, p. 16.

". . . 'we get a composite opinion of every man' . . ."

jobs that job rotation and enlargement can be used.

An official of an A.F. of L. union (before merger of the Federation with the C.I.O.) made this observation to our study group: these job techniques fit in closely with the apprentice program that the union has been trying to expand for years. The union, he said, wants to turn out a journeyman with broad skills. They hope that apprenticeship eventually will qualify a man to do any job and operate any machine covered by his classification.

The union's attitude suggests that, on this subject at least, easy agreement with management may be possible.

Some Added Advantages

Evaluation of personnel is facilitated by job rotation, in the opinion of a high-level supervisor at Esso's Baton Rouge refinery.

"We get a composite opinion of every man, rather than having him judged by only one supervisor," he said. If a person impresses supervisors on several jobs, the company can conclude that he is well qualified for a higher position. Also, promotions are less likely to be influenced by favoritism.

At a large plant in the east, the employe's-eye view of job rotation was expressed to me in the words of this foreman:

"The best thing I like about it is that when you get under a boss that you really don't like or can't get along with, you know you won't be there too long. At some plants you can get stuck under the same guy for 10 or 15 years. But here we just go ahead and do our job the best we can and try to get a good rating from him, for we know we'll be out of the situation in a year or two at the most."

Proper delegation of authority can be aided by job enlargement, especially where delegation hasn't been carried out much below the level of plant manager—often the case in large corporations today. Here's how job enlargement helped at the I.B.M. plant in Poughkeepsie, N. Y., where electric typewriters and electronic equipment are made.

A typical machine operator needed two men to help him do his job: one set up the machine, the other inspected the operator's work. Then the company gave all these functions to the operator. It has turned out well. Although he commands a slightly higher salary, the increase in production and decrease in spoilage more than makes up for the difference. Besides, the operators say they like their enlarged jobs better, and the lower turnover and absenteeism rates bear them out.

There are routine jobs in refineries that would benefit from this approach.

Are There Objections?

Job rotation and job enlargement are not without limitations. Let's look at two major objections.

Objection: *"Why trouble to train a man for a job only to lose everything when he moves to another department?"*

About this a manager said to me:

"Tommyrot! The company still has this experience within its ranks, and a good portion of it will be applicable to the new job. A man really starts studying when he gets a new job, but will taper off after about six months. This way we keep him studying all the time."

It is true that companies applying these principles will be doing more training than others, but many firms with a long-range viewpoint consider this a healthy sign.

A more serious objection concerns some of the highly technical jobs in an oil company. It would, indeed, be unwise to rotate men in and out of them indiscriminately when the jobs themselves require years of background.

Objection: *"Some men just don't want these changes."*

True, and for them exceptions should be made. Our study group came across workers who were entirely content with the limited range of their jobs and wanted no part of rotation. Any company would be mistaken in forcing them into new positions.

A somewhat different situation is the engineer or scientist who is happy to stay with a specialty. He is growing within it and developing a profound knowledge. This aspiration is receiving greater recognition in many companies today with the creation of special titles for senior scientists and engineers. This is a welcome trend as long as it doesn't divert from management careers the young technicians—perhaps not fully aware of their mature inclinations—who must assume business leadership in the future.

Making the Change

Everybody, from the president to the lowest-ranking employe, is suspicious of any change that affects him. Supervisors must be aware that changes in the status quo call for tact and ample explanation.

Our study group was told about a refinery in which the supervisor of a small technical group in the yard was brought in to supervise a different type of technical group in the main office. The man was not thoroughly grounded in the new work, but he was apparently liked and considered a competent supervisor.

Yet, soon afterward, two of the men in the group resigned and others asked for and obtained transfers. Most of the best men in the group left, leaving it undermanned and disorganized. Although there were other factors involved, much of the disaffection arose because no one from the group had been promoted to fill the original supervisor's job.

What can we learn from this example? First, that management must be certain the new man can handle the job. Next, that relations between the people concerned must be handled with great care. In this example, an explanation to the employes of the company's rotational policy and of their chance to participate in it in the future might have saved the situation. But no explanation had been made.

In conclusion let me say that, used properly, job rotation and job enlargement can make a definite contribution to the improvement of working relations in the oil industry. Improvement in morale should bring in its wake improvement in output. The company should eventually have better trained employes up and down the line, able to take over additional responsibility when the time comes.

Finally, management can get some satisfaction from knowing that it has made life a little more interesting for the people under them by providing an outlet for their unused abilities.

Meet the Author

This is Joe R. Fuller's second appearance in PETROLEUM PROCESSING. In August, 1954, he offered "Eight Dollar-Saving Tips to Keep Construction Costs Down," and then (on the strength of it?) enrolled at the Harvard Business School to study for a master's in business administration.

After graduation the following June, he joined Creole Petroleum Corp. and is now an engineer at the Amuay refinery in Western Venezuela. This isn't his first experience with quonsethut life in that country. While studying for his B.S. in civil engineering at Texas A. & M. College, Mr. Fuller took leave for work as a field engineer with a refinery builder in those parts. But he returned to college, took his degree in 1951, and spent the next few years as an engineer and a chief engineer with a major construction firm erecting refinery and chemical plant units on the Gulf Coast.

Mr. Fuller is a Texan—a native of Port Arthur.

BRING THE PUBLIC to your plant; show them your equipment, facilities, offices . . .

TREAT THE PUBLIC WELL and give them the facts

Help yourself and your industry:

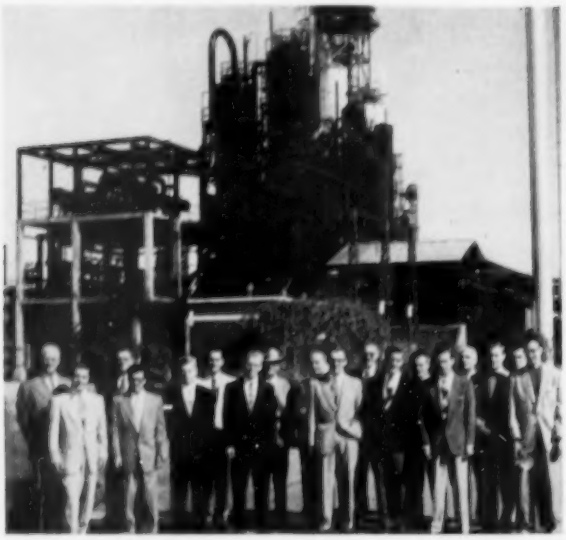
Tell the Public the Oil Story

WHAT'S up at your plant for Oil Progress Week? The bright lads are already at their planning boards. Why so early? Because it takes time to put across a successful observance of OPW, and success here is important to you, to your company, and to the oil industry.

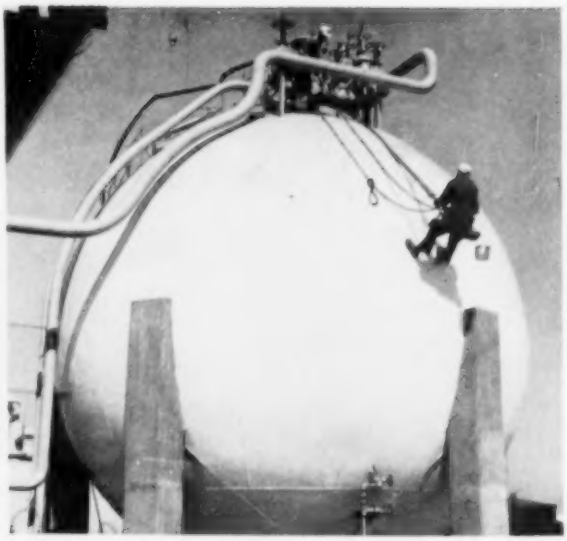
If you're still in the dark, Oil Progress Week (Oct. 14-20, this year) is the time when the oil industry wears its heart on its sleeve. Oilmen make a special effort to talk to the public, to explain the facts of industry life, and tell people how oil has become essential to our standard of living. "Those Who Know You Well, Think Well of You" is the idea, and the industry needs more of that public support.

OPW is industry-wide and nationwide. It is sponsored by the American Petroleum Institute and given active aid through the Institute's Oil Industry Information Committees. These are established throughout the country and stand ready to help with free materials —pamphlets, films, posters, etc.—and free advice. But you've got to call the plays.

Now is the time for planning. With only 3½ months before The Week you must start thinking right away



OIL MEN FOR A DAY. These selected high school students received special attention, made project successful



PAINTING AND CLEANING in preparation for Oil Progress Week points up shipshape condition of plants

of what kind of activities your company will program.

Here's an Idea Grab-Bag

Need tried-and-true ideas for your company's promotion of OPW? To help you kick over your mental motor, take a look at this list of what some refiners have done for OPW:

- **Open house** with a refinery tour for employes, their families and friends; for the whole community; or for some special group your company would like to reach
- **"Oilman for a day"** events with local high school students
- **"Magic Suitcase"** and "Magic Barrel" demonstrations in the community
- **Showing of OIIC** films in schools and commercial theaters.
- **Paid promotion** through community papers and radio; window posters, bumper strips and pump island banners distributed to employes and townspeople

Your OPW promotion doesn't have to be large-scale to be effective. If your budget can take it, and you want to go all-out, you can invite 40 or 50 newspaper editors from the region to visit your plant, fly them to and fro, and foot the entire bill. One oil company did this two years running, and there's no doubt it was effective. But you can make a dent in your community with a more modest effort, too, if you'll do two things:

1—Know who the people are you want most to reach.

2—Don't "scatter" your shots; plan carefully and early so that you reach the right group.

Let Employes Carry the Word

At the Lima refinery of Standard Oil Co. (Ohio), management is convinced that employes are the company's best public relations representatives. As General Superintendent George Pugh puts it:

"Hardly a week goes by that we don't hear an outsider remark about some favorable aspect of the company's business and employe policies that he has picked up from an employe. It also follows that the employe who does the best public relations job is the one who can give a factual, on-the-spot answer to questions raised by his friends and neighbors."

Sohio management at Lima organized a Family Night at the refinery last year. They showed the OIIC film "Barrel No. 1," had a "Magic Barrel" demonstration, and threw in plenty of handouts for the children. During the preceding week, the refinery manager sent a letter to each employe explaining the objective of OPW. Bumper strips and the OIIC pamphlet "Do You Know the Answers" were also distributed, and there was additional publicity given through the plant newspaper and the poster display program.

Put Planning Onstream Today

Early planning is a must for a smooth flowing product, and people at Kendall Refining Co. Bradford, Pa., are taking advantage of the time left before October. Right now, planning has begun at the "steering committee" level.

Informal idea-sessions over coffee, occasional memos and phone calls are being exchanged already among the men who take a leading part in OPW activities. Kendall refiners begin early because they traditionally put on a big show and that means lots of details to nail down.

Last year there were a number of plant tours and open houses, which introduced many civic, social and school groups to the refinery. But that was just the beginning. A special speech—prepared with the aid of OIIC materials—plus the newest OIIC film were presented at every service club in the county. Kendall promoted OPW in the local newspapers with paid advertising, and assisted one paper in preparing a special edition on the oil industry. All of Kendall's radio and TV newsbroadcasts included references to OPW. Furthermore, 100 window posters, 300 bumper strips, four pump island banners and four exhibits were distributed for display in the area.

The people at Kendall are going to repeat all this in the 1956 Oil Progress Week. That's why they've got their plans onstream already. By the middle of August, bull-sessions will turn into full-scale planning meetings and these will be held more and more often as October approaches. Nobody's asleep at Kendall.

How to Open That House

One of the friendliest and most effective of company-community get-togethers, the plant open house, requires lots of preparation. To set about it you could do worse than follow the blueprint of Esso Standard Oil Co.'s Everett, Mass., refinery.

In 1955, a committee set to work four weeks before the big day. It was composed of supervisory and hourly paid people, including union representatives. The public relations member of the employe relations department was its head. Subcommittees were appointed to organize displays, souvenirs, transportation, parking, housekeeping, refreshments, guides and a plant tour route. A safety engineer served on the committee to see that safety regulations were followed. He also set up an emergency and first-aid plan.

Clean-up and paint-up was the order of the day for a whole month before. As the open house was for employes and annuitants and their families, the refinery manager sent invitations to each and enclosed stamped reply cards. The plant news bulletin carried additional announcements.

As open house day approached, the tour route was laid out on a map of the refinery and all guides were given copies to follow. Each escort had a megaphone or portable loud speaker. Guides held "dry runs" to clock the event. They were given outlines listing the few restricted subjects, as well as the information they could disclose freely.

Scale models of the Fluid cat cracker and several other units were placed in prominent locations. Even such activities as the suggestion system were illustrated, and an explanation was given by a thoroughly briefed employe at each exhibit.

An unusual display was a test car on loan from a supplier of tetraethyl lead. It showed knock-testing of engines and the instruments used to test engine performance.

On Open House Day about 1000 persons were in the refinery during the four-hour period. The committees had done their work well and hospitality and promotion of Oil Progress Week were happily wedded.

Some special conveniences:

- Members of the refinery-supported Girl Scout group baby-sat for children who could not accompany their parents on the entire tour;
- A continuous program of movie shorts and cartoons was presented at the refinery for children;
- A professional photographer took candid pictures of family groups and recorded the day's events;
- A printed program was given to each family group as it arrived.

In the way of personal cordiality, the refinery manager, general superintendent and department heads greeted employes at various points on the tour.

Educational Or Just Fun?

Open house is a good way to show the technical progress of the industry, in the opinion of H. E. Handy, manager of the Robinson, Ill., refinery of Ohio Oil Co. Furthermore, he told PETROLEUM PROCESSING "I believe we also effectively communicated the competitive nature of the industry and demonstrated how such competition results in better products and services."

But it even reached down to the everyday, working level, he thinks. For success in refining operations, he says, "depends in part on our being understandable to the community in which we work. Rumors or indifference grow where people are aloof or unfriendly."

Unlike the Esso Standard affair at Everett, Ohio Oil's open house was for the whole town. Therefore, a slightly different approach was needed. Handy sent individual letters to employes, city officials, community leaders, oil dealers and jobbers in the area. Customers of the refinery were invited through stuffers sent out with accounts receivable statements. By advertising in local newspapers, management notified the general public of the time, place, sights to be seen, and other details.

A novel feature of the Robinson open house were the 10-car caravans organized to take visitors over the tour route. It was considered impractical to plan a walking tour over the plant's 500 acres. A refinery engineer in a sound truck went with each caravan and explained the processes in non-technical terms.

By any standard, the open house was a major success, as half the town's 6000 people were visitors. An estimated 28,000 additional people saw newsclips of the event over TV that night.

Get the Kids Into the Act

Just as the TV giveaway program is hard to beat, so some kind of participation in company affairs is sure to stimulate lively interest. One of the best participation ideas is "Oilman for a Day."

Let's see how it can be organized by following what was done at Sun Oil Co.'s Marcus Hook refinery last year. High schools in the area selected 56 seniors to visit the refinery. The company had them transported from their school to the plant by cab.

First item was a welcome talk and simplified explanation of refining processes. Then two students were assigned to each of 28 top management jobs at the plant and escorted to work by the supervisors themselves. "Work" lasted one hour and lunch was served in the conference room, with members of management at hand to answer questions.

At the beginning of the day each student was given a specially prepared kit including: a booklet on the refinery's workings, an "Oil Refiner for a Day" notebook, Oil Progress Week literature, a schedule of the day's activities, a list of the supervisors participating and names of the students and their schools.

Because "seeing is believing" each person was given an 8 x 10 photo of himself in the role of refinery supervisor. What's more, the influence of the visit was extended by sending another print of each photo to the editor of the various school publications, with an offer to have engravings made if the school budget was limited. Several editors took up this offer. This was good public relations work. Each student contacted and influenced a number of other people at school and at home. The company and Oil Progress Week received additional publicity from newspapers in the area.

The returns must be there because the "Oilman for a Day" idea has caught on with quite a few companies. Moreover, it's suited to small as well as large plants. Just a few of the small refineries that have tried it: in Salt Lake City, both Utah Oil Refining Co. and Salt Lake Refining Co.; in Denver, Continental Oil Co.'s refinery and Bay Petroleum Co. It's an idea that doesn't have to be limited to Oil Progress Week, either. In fact the Esso refineries feature "Oilman for a Day" affairs regularly in the year as well as during OPW.

Where to Get Help

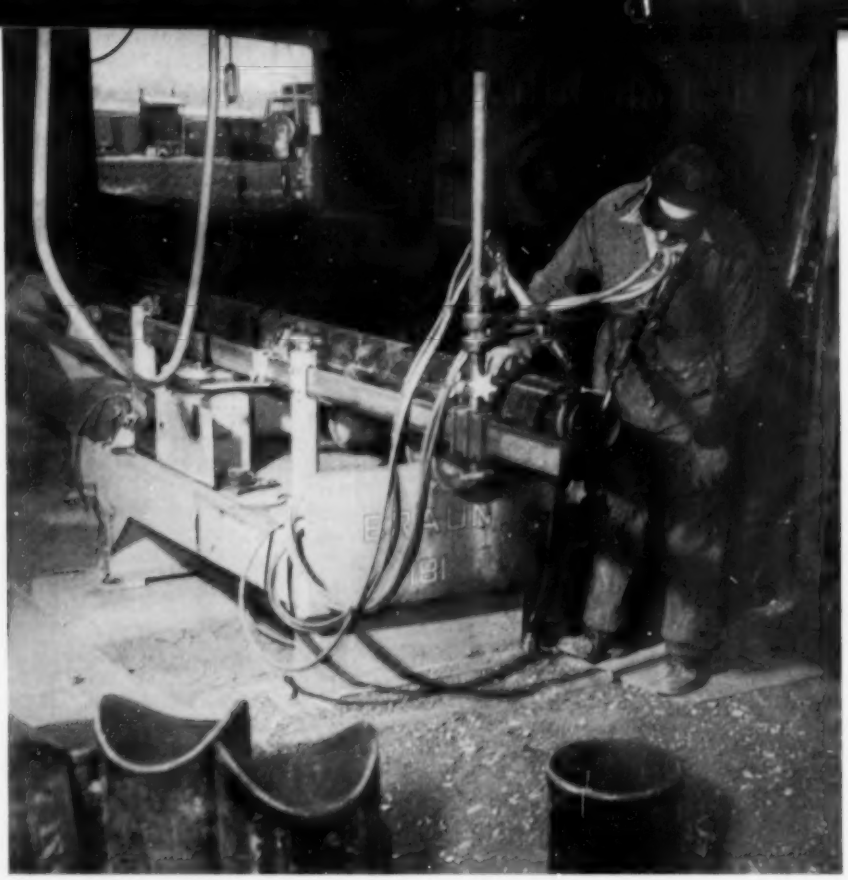
Once you've decided to move ahead with an observance of Oil Progress Week, you'll be interested in the help you can obtain from the Oil Industry Information Committee. Besides the actual display materials it can provide, OIIC booklets and the advice of your local representative can help you over many of the bumps.

Your local OIIC man will have the answers to a great many of your problems. But now's the time to get busy! October's just around the summer.

Acknowledgment

This article was made possible through the cooperation of the API and several refining companies throughout the country. Photos were furnished by Ohio Oil Co. and Esso Standard Oil Co.

Good planning moves pipe through giant temporary shop in four steps



STEPS 1 and 2 Cutting and Fit-Up. 8-in. pipe cutter handles straight lengths not cut on pantographs. Cutting and bevelling are done at the same time to a tolerance which can be held to 1/16-in. Fitting arrangement is shown on the spool sheet accompanying each piece. Elbows, nipples, flanges and other fittings specified on the spool sheets are tack-welded to straight lengths on special fit-up tables for finish-welding later.

500 Spools a Week Now

IT'S A PIPE SHOP NOW, but in a few more months, it will be gone forever—turned into a maintenance shop and warehouse for Tide Water Associated Oil Co.'s new refinery a-building near Wilmington, Del.

By that time, this amazing shop will have fabricated some 24,000 spools of pipe for the largest "from-the-ground-up" refinery ever built.

The 500 spools/week rate is a result of careful planning by C. F. Braun & Co., prime contractor for the 130,000 b/d refinery. Planning had to be thorough to handle so many spools so quickly.

Considerable time was spent on the plant layout. After reviewing the experience gained in operating their own pipe shop in Alhambra, Calif., and after consultation with other large pipe shops, Braun chose straight-through material flow, parallel to the long axis of the building. The straight lengths of pipe and the necessary fittings flow in at one end of the building and leave from the other as completed spool pieces.

In the building, the pipe travels in four main steps: (1) cutting to length, (2) tack-welding at the fit-up table, (3) automatic welding or table welding of fittings, and (4) inspection and loading for field assembly.

To supervise and keep close control of all pipe shop work production, Braun brought several of their staff members from Alhambra. Jack Petralia, who is now in charge of the pipe shop at Tide Water, had many years of experience as a foreman in the fabrication shop in Alhambra. (His work there included development work on automatic welding, which Braun uses extensively on main vessel seams.) He combined his experience with that of others on Braun's research and manufacturing staff in laying out this large temporary shop.

All work in the shops is done from pipe spool detail drawings, which are orthographic projections of sections of pipes. These are detailed from the large assembly drawings too involved for shop use. Release of the spool drawings from the engineering section at the refinery site is tied in closely with the material flow system. This system pinpoints the status of pipe work to date, work ahead, and work yet to be released.

About 20,000 to 24,000 spool pieces (10-in. and under) will be fabricated by the pipe shop, with each spool carefully coded by number to its process unit. As the spool drawings

STEP 3 Final Welding. One of four welding units mounted on building columns is welding automatically. Two 2,500-lb. positioners have been adapted for positioning and rotating pipe. At least two passes of the submerged arc-type welder insure good seams as the pipe is rotated for each weld.

STEP 4 Inspection and Assembly. Pipe is brought to the field pre-erection assembly area by trailer where it is laid out according to its process unit destination. Inspection, both visual and radiograph, has already been made. Cobalt is used to radiograph about 8% of the welds. Visual inspection is made continuously.

but Gone Tomorrow

are released to the pipe shop for fabrication, the needed materials are released from the main warehouse. Thus, all fittings and pipe scheduled for fabrication accompany the working drawings to the pipe shop, and no material delay is apt to prevent smooth flow through the welding operations.

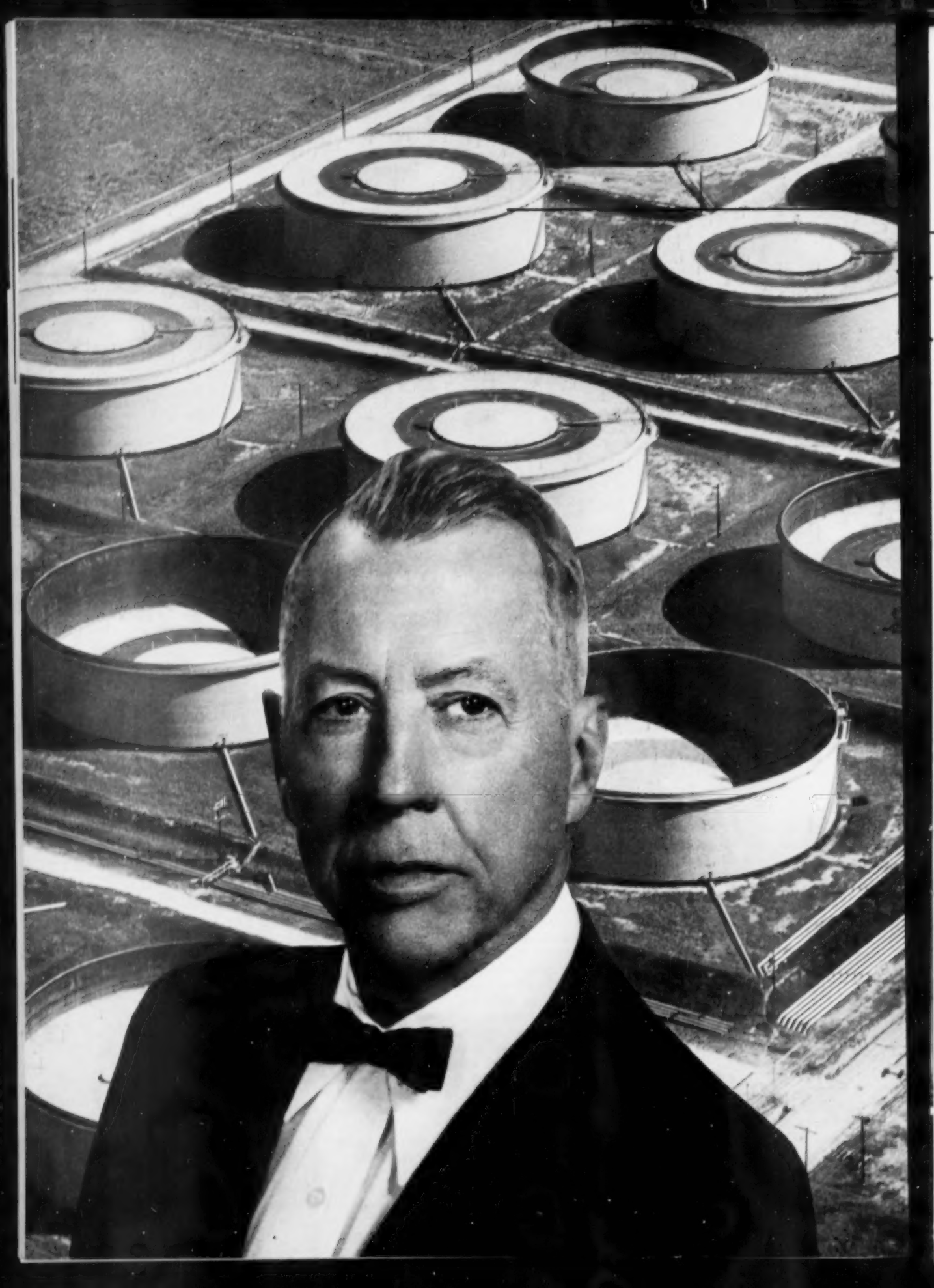
All pipe is purchased in single, double and random lengths. A working supply is kept just outside the shop entrance near the cutting benches. A single spool normally includes four butt welds, and follows the typical path through the shop shown in the pictures above.

To date, the pipe shop has been averaging about 500 spools/week. If this rate continues, it is hoped that the shop can be dismantled soon after the middle of this year. A concrete floor will then be poured and finished for use as Tide Water's own maintenance shop and warehouse.

Cold bending of 2-in. and under pipe is done in a small corner of the shop. Another secondary project, going on just outside, is the welding of large sleeper lines. Three-length sections of the large pipe are roll-welded before installing on the sleepers. This helps reduce the "bell hole" welds.

To prove that so big a job could be handled efficiently in a temporary shop, Braun set up close material controls. Cumulative wall charts show: 1) status of the whole job at any time, 2) number of spools released by engineering for fabrication, 3) number of spools completed to date, and 4) number of spools completed per man-day. Operating costs, when needed, can be obtained by sending the same data through a punch-card machine.

IN AND OUT New pipe is stored outdoors, awaiting fabrication. Finished configurations are taken (below) to pre-erection assembly yard, shown above in Step 4.



JOHN WIGGINS' ANSWERS TO 11 QUESTIONS CAN HELP YOU SELECT A BETTER FLOATING ROOF SEAL

Are all floating roof seals the same? What about safety? Conservation? We asked John Wiggins, inventor of the floating roof and noted conservation authority, to answer questions most commonly asked about the new Wiggins Safety Seal.

1—**Q.** In the new Wiggins Safety Seal does any of the mechanism contact the liquid?

A. No. All metal working parts are out of the liquid and away from corrosive vapors. This means longer life—continuous use.

2—**Q.** Does the new "Weather Hood" provide longer fabric life?

A. Yes—the fabric is protected from the sun and other elements—lower temperature under the hood provides added conservation.

3—**Q.** Is the fabric seal made of the regular material?

A. The fabric used in the Wiggins Safety Seal has been specially designed and compounded to insure longer life.

4—**Q.** Is this seal difficult to inspect and maintain?

A. Not the Wiggins Safety Seal. The mechanism is designed for easy visual inspection and maintenance.

5—**Q.** In old style seals, rust and scale accumulate and shorten seal life. Does this happen with this seal?

A. In the Wiggins Safety Seal the design of this "Weather Hood" prevents rust and scale from depositing in the "seal loop"—thereby increasing seal life.

6—**Q.** Does the Wiggins Safety Seal prevent rim fires?

A. Yes—design of the seal virtually eliminates critical vapor spaces where air and vapor collect to form explosive mixtures. When exploded through controlled tests, the fabric was able to expand enough to contain the explosion without tearing.

7—**Q.** Is this seal safe for the storage of low vapor-pressure, low flash-point liquids such as jet fuels?

A. Yes, the design of the Wiggins Safety Seal reduces the danger area to a minimum so that it can be used in the storage of jet fuels with complete confidence.

8—**Q.** This seal is new. How do I know it will work?

A. The materials used in this seal have been proved in actual service operation. General American's experience is your assurance of satisfactory performance.

9—**Q.** How does the Wiggins Safety Seal guarantee maximum protection against evaporation loss?

A. Air-vapor volume of the Safety Seal is less than 10% of the present volume for floating roof seals. This would eliminate most losses. In addition, the air-vapor space is shielded by a "Weather Hood". This area—*the area that breathes*—reduces losses to a minimum.

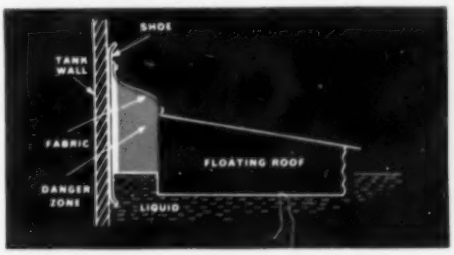
10—**Q.** Will the Wiggins Safety Seal save me money?

A. Yes—by eliminating losses due to thermal breathing, preventing rim fires, use of new longer-lived fabric, protecting the mechanism from liquid and corrosive vapors and permitting much longer periods of "in-service" operation. These exclusive benefits are so valuable that the new Wiggins Safety Seal will pay for itself with the conservation savings it makes possible.

11—**Q.** Why have you put so much emphasis on the seal?

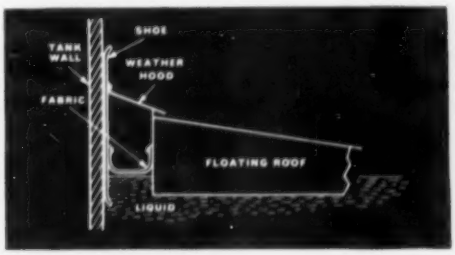
A. *A floating roof is only as safe as its seal.* With the new Wiggins Safety Seal, Wiggins floating roofs are in a class by themselves. Since General American makes all types of floating roofs, you can have the Wiggins Safety Seal on the roof that best meets your needs—whether it be the Wiggins Hidek*, Lodek* or Doubledek*.

**Patented*



OLD

With the old type seal, the fabric is exposed to the sun's rays and explosive vapor collects in the large space between the liquid and the fabric; the mechanism is submerged in the liquid and exposed to corrosive vapors.



NEW

With the new Wiggins Safety Seal, vapor space under the circumferential fabric is reduced to a minimum. Ends spark fire hazards. Fabric is protected from the sun. Mechanism is out of liquid and corrosive vapor space.

WIGGINS VAPOR SEALS GENERAL AMERICAN

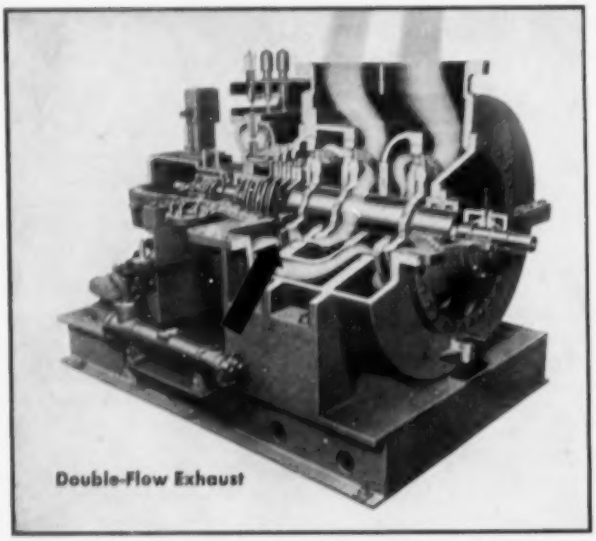
To see why Wiggins floating roofs pay for themselves, write or call your General American sales engineer.

PLATE AND WELDING DIVISION

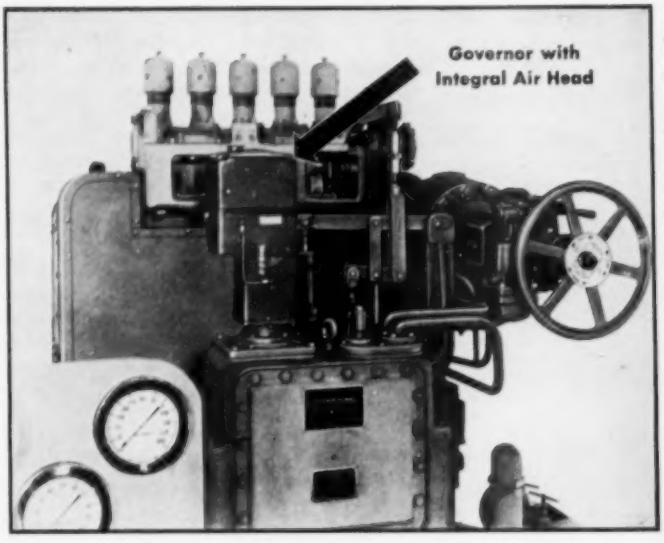
GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South La Salle Street, Chicago 90, Illinois

In high-speed turbines . . . why does in total horsepower and



GREATER RELIABILITY. Worthington's rugged construction pays off in extra reliability. Solid rotor for modern high speeds, double-flow exhaust where large volumes of steam are used in condensing operation, and Kingsbury type thrust bearings are just a few of the features that assure safety and dependable service on your vital compressor and blower drives.



ACCURATE SPEED REGULATION. Exclusive Worthington governing system using governor with integral air motor gives you speed control response to .04 psi change in control pressure. And it provides for remote automatic operation if you need it. The oil relay type governor so equipped instantaneously controls pressure or volume delivered by the compressor regardless of steam variations.

Where turbine-driven compressors and blowers are used, down-time is usually mighty expensive. Particularly so if failure can bring a continuous process to a standstill. In the case of high-speed/high-horsepower compressor-drive turbines, your surest way to design reliability into your plant is to specify the turbine line with best *proven* performance.

Compressor-drive turbine installations up to 12,000 rpm, and 24,000 hp, show Worthington leads in application engineering, design, reliability.

Worthington compressor-drive turbines are conservatively built with all stresses carefully calculated and kept well within established safety margins. Also, measured load tests are performed on every unit at the factory with modern facilities, under the watchful eyes of highly trained personnel.

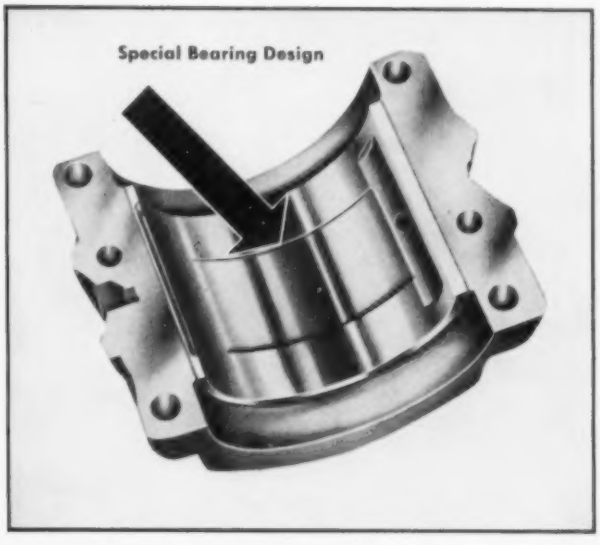
One feature seldom claimed is that of lowest price. That is inconsistent with quality, and quality is something Worthington engineers will not compromise. For critical operations, buying the best is lowest cost insurance against process equipment failure.

Get the complete story of high-speed/high-horsepower compressor-drive turbines by writing Worthington Corporation, A&SP-Turbines, Harrison, New Jersey. Ask for your personal copy of Bulletin 1966.

On Vital Compressor and Blower-Drive Applications . . . It Costs Less to Invest in the Best!

WORTHINGTON

WORTHINGTON lead all others number of installations?

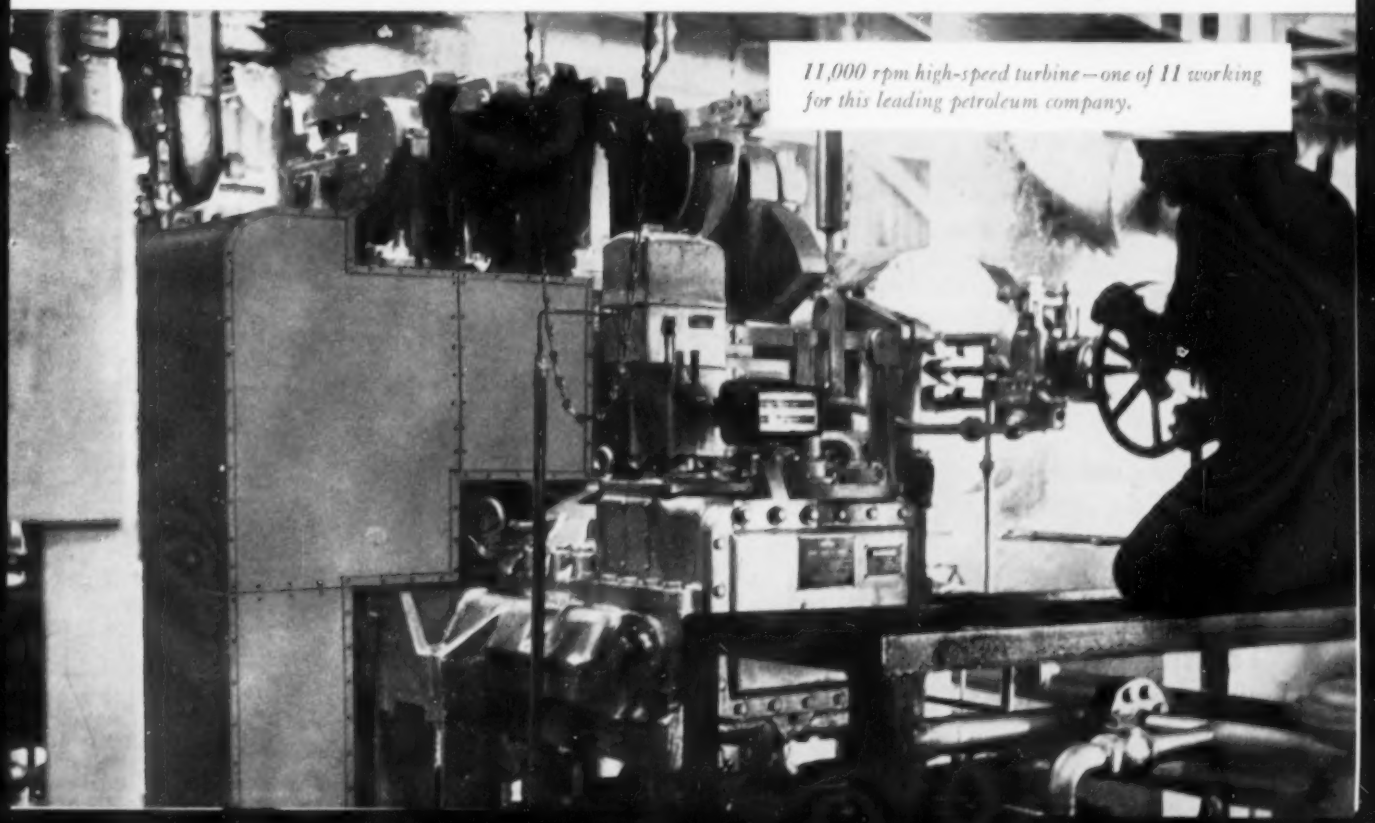


To meet turbine spec's. 4000 Hp· 7250 RPM ·Steam 210 #·550° ·26½"
WORTHINGTON GIVES YOU ALL THIS—CHECK AND COMPARE:

	Feature	WORTHINGTON	Company A	Company B	Company C
Rotor	Solid—to withstand extreme stresses.	✓			
Main Bearings	Anti oil-whip—for longer turbine life.	✓			
Thrust Bearing	Kingsbury type—for proven reliability.	✓			
Automatic Nozzle Control	Cam operated—for economy and better control.	✓			
Governor	Has integral air motor—for more accurate control.	✓			
Type Construction	Double flow exhaust for economy and long life.	✓			
Packing	Labyrinth—for most effective seal at high speed.	✓			
Test	Load test—to be sure you get what you ordered.	✓			

LOWER MAINTENANCE COST. One important example of construction used to help eliminate non-scheduled maintenance is Worthington's anti oil-whip bearing. During operation a pocket (arrow) in the upper half of the bearing builds up a pressure pad of oil. High pressure here creates a downward force on the journal, holding it in place in the bearing, preventing destructive vibration.

LONGER LIFE. A long, trouble-free life can be attributed to no *one* turbine feature, but rather a combination of many engineering advances. Compare design features yourself, one by one. Far ahead of any other manufacturer in the compressor-drive field, Worthington's first compressor-drive turbine built in 1927 is still working around the clock, in a large Eastern gas plant.



11,000 rpm high-speed turbine—one of 11 working for this leading petroleum company.

Evaporation reduced with Microballoon spheres!*

Annual loss of 13,500 barrels reduced to 2700 barrels

In this tank farm, evaporation loss has been sharply reduced by the use of a ⅜-inch layer of Microballoon spheres. Capacity of the farm is 400 thousand bbls., four tanks operating on approximately a 7 day cycle with 7 RVP oil. The fifth tank handles 4 to 5 RVP oil on a 23-25 day cycle. Pipeline rate is 40 thousand bbls. per day.

Here's evaporation control that talks money . . . an estimated $32,500 saving! And this installation paid for itself in a matter of months.

In October 1953, 22,000 pounds of Microballoon* spheres were installed in the five cone-roofed tanks at the Salem, Illinois station of the Sohio Pipeline Company. Two years later this same installation is still operating *without additional investment!*

Microballoon spheres are non-abrading, won't harm tanks, pipes or pumping equipment. For further information, write Bakelite Company, or *Chicago Bridge & Iron Company,* Chicago 4, Ill.

*Registered trade-mark of The Standard Oil Co. (Ohio)

for evaporation control...

BAKELITE BRAND RESINS

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC

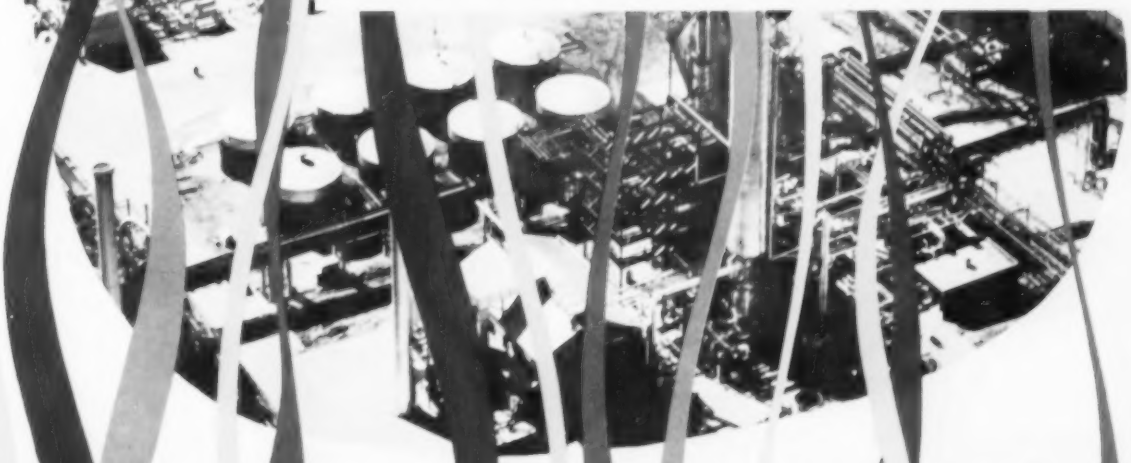
A Special

PETROLEUM PROCESSING Report

By Willis A. Bussard
Assistant Editor

EVAPORATION LOSSES

and their control in storage



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Control those **evaporation** losses ... it means 'money in the bank'

SAVING those dollars lost by evaporation to the atmosphere during storage is an old problem for the petroleum processor.

One of the first comprehensive reports on the problem was issued back in 1922 by the U.S. Bureau of Mines. Recently, in 1952, a symposium of the American Petroleum Institute focused attention again on the many conditions responsible for what is not only an economic loss but also the loss of a valuable natural reesource.

Today, an estimated 3% of all petroleum produced in this country is lost by evaporation on its way from the wellhead to the consumer. This loss, therefore, amounts to about 75-million bbl, or $300-million each year.

What can be done about it? The refiner has a big stake in the problem, and can do a lot to help solve it. He has tanks at both ends and in the middle of his plant —those holding crude oil and incoming raw materials, those holding finished products, and a tremendous amount of intermediate or rundown storage.

This special 24-page report is aimed at three major targets: 1) what is evaporation and what causes it, 2) what types of evaporation losses confront today's petroleum processor, and 3) what equipment and techniques can reduce these losses.

There are other reasons, too, for preventing or reducing evaporation losses during storage—among them, safety, corrosion, and possible air pollution.

As refineries continue to grow in size, it becomes increasingly important to eliminate as far as possible any hazards associated with the storage of explosive and flammable materials. Already, for example, many conservation type tanks are being required for safe storage of the JP type jet fuels. And safety valves and special vents have always served two purposes—conservation and safety.

Corrosion reduction is an important contribution made by certain types of conservation equipment, particularly floating roofs and special surface coverings. The growing use of sour crudes by many refiners makes this additional advantage an important justification for installing conservation-type storage equipment.

And finally, there is the matter of potential air pollution. Civic pressure in one area of the country has spurred the increased use of conservation type facilities. Although the need for such extreme methods of atmospheric pollution prevention may be questionable, there is little doubt that they have succeeded in saving hydrocarbon vapors previously lost. Even in other geographical areas, the control of such "nuisance vapors" goes a long way towards reducing losses.

Significant of the oil industry's concern today with the problem is the active work of the API Committee on Evaporation Losses. This group is now preparing a detailed manual (scheduled for publication in 1957) which will be a comprehensive, as well as technical, report on evaporation losses.

What this report **contains** . . . .

What Evaporation is, and the storage conditions which affect it . . . . . **page 106**

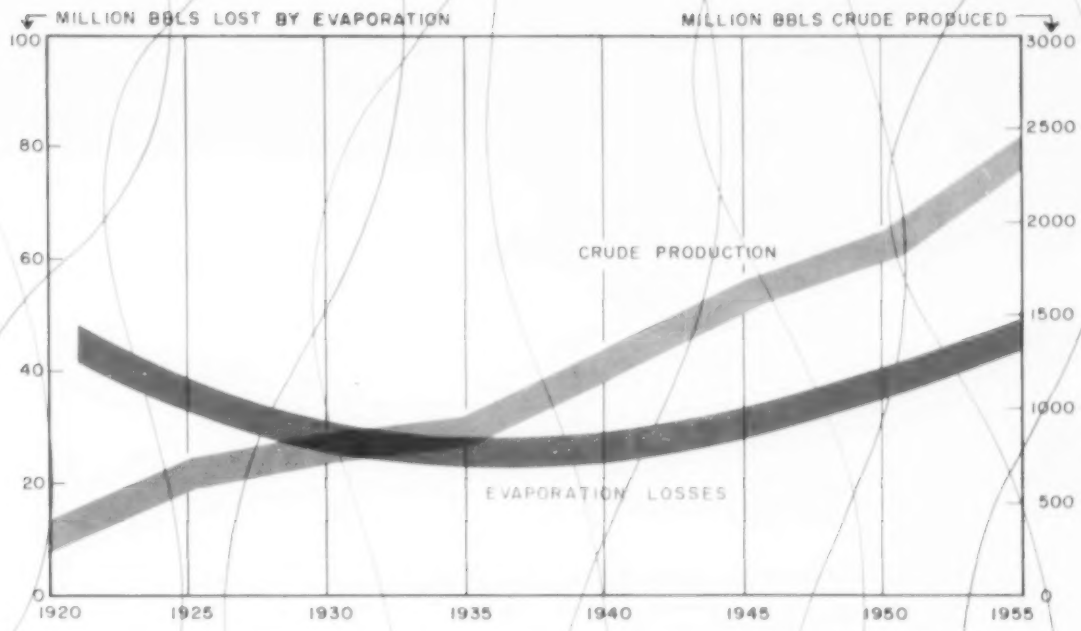
The Types of Evaporation Losses . . . . . **page 109**

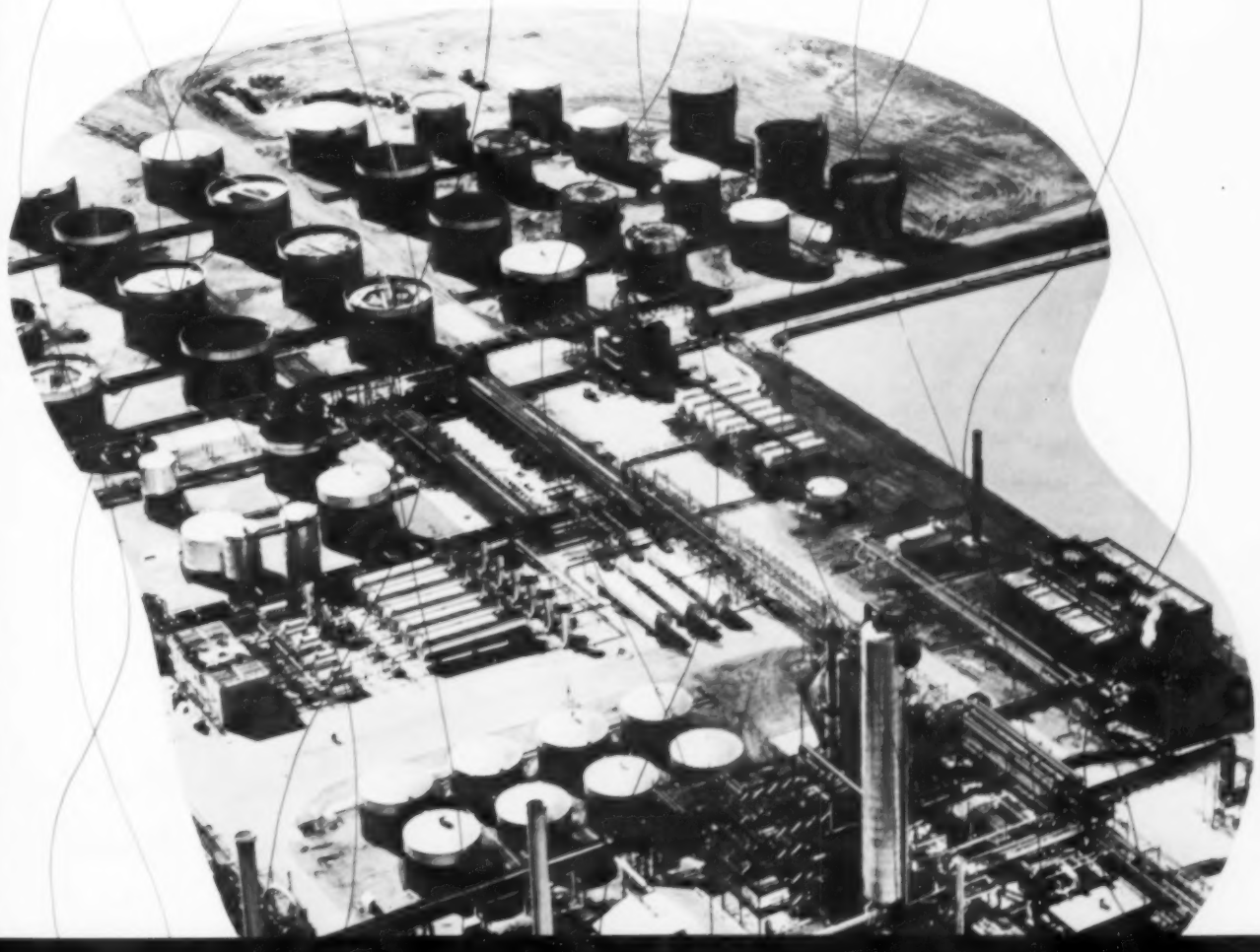
. . . and their Causes . . . . . **page 110**

The Equipment used to Reduce Losses . . . . . **page 112**

. . . plus other Ways to Reduce Losses . . . . . **page 122**

Estimating Losses and Selecting a Tank . . . . . **page 125**

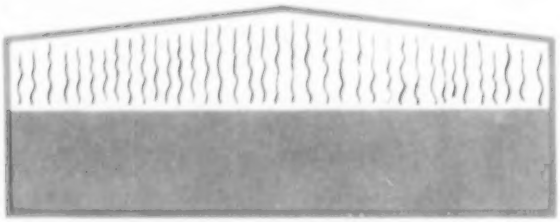

MILLION BBLS LOST BY EVAPORATION
MILLION BBLS CRUDE PRODUCED
100
80
60
40
20
0
3000
2500
2000
1500
1000
500
0
CRUDE PRODUCTION
EVAPORATION LOSSES
1920
1925
1930
1935
1940
1945
1950
1955



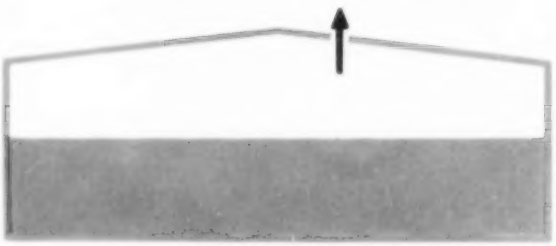
Here's what **evaporation** is ...and 4 storage conditions affecting it

1—Temperature of liquid

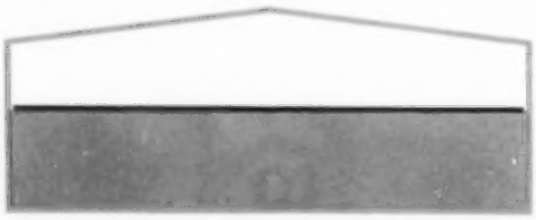
2—Vapor space above liquid



3—Renewal of 'air' above liquid



4—Area of liquid surface



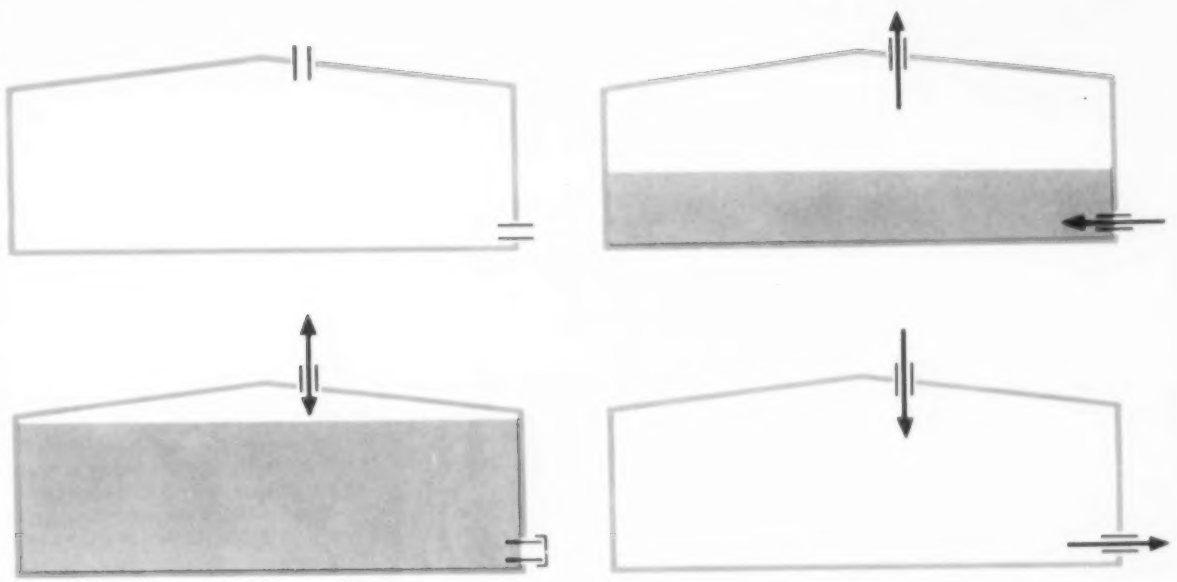
Evaporation is the physical change of a liquid into a vapor or gas. It is a physical change only, not a chemical change.

For crude oil and petroleum products, the exact physical conditions causing this change are difficult to define. Pure substances vaporize at certain temperatures and pressures. But petroleum products are mixtures. Their behavior is, therefore, difficult to predict without knowledge of their exact composition. Once the composition is known, however, evaporation characteristics can be derived by complex calculations.

Four principal storage conditions affect the rate of evaporation of any liquid:

1. **Temperature of liquid surface**—this affects the amount of vapor that will leave the liquid.
2. **Quantity of the same vapor in the space above** the liquid—this concentration permits evaporation only until pressure of the vapor above equals that of the evaporating liquid below.
3. **Renewal of "air" over the evaporating surface**—removing any vapor from above its liquid will permit further evaporation.
4. **Area of the evaporation surface**—the greater the surface area the more the vapor that can form.

How each of these factors affects the rate of evaporation can best be shown by the analysis of a typical storage tank, shown on the next page.



Evaporation
in a typical storage tank

Assume a simple fixed roof tank of about 20,000 bbl capacity, with a diameter of 60 ft and height of 40 ft. Made of steel according to API Std 12C, it probably looks like the tank shown in the accompanying sketch. Assume further that the tank has just been built, and is ready for use; it is clean and properly equipped with an inlet, outlet and vent.

Two of the four storage conditions affecting evaporation rate are illustrated if the tank is filled, and then emptied the next day. Let's examine this testing in a step-by-step fashion.

As the tank fills, the liquid rises slowly to the top, pushing air previously in the tank out through the vent. The tank is then almost filled with liquid, with a small vapor space left at the top to prevent overflow.

If we let the liquid stand in the tank for 24 hrs while testing for leaks, changing atmospheric conditions will affect the stored liquid. If the temperature outside the tank rises, it rises inside too. Any increase in temperature of a liquid speeds evaporation. Thus, as the temperature rises, vapor is driven off. If the tank is vented to the atmosphere, this vapor is lost.

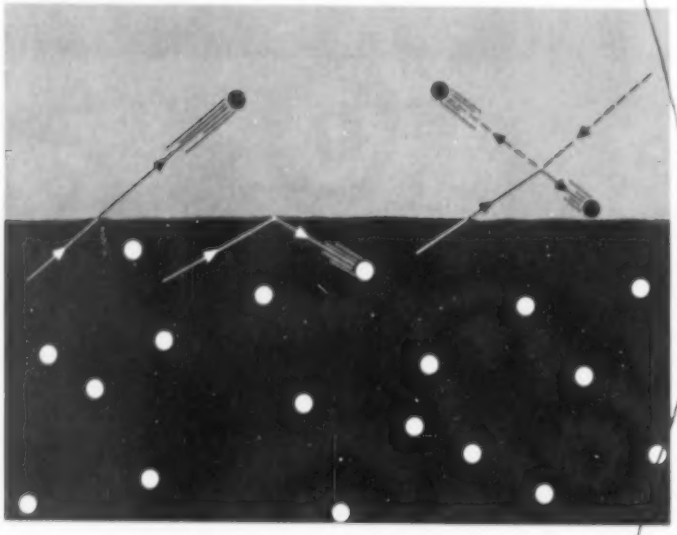
But, the temperature over a 24-hr period will also fall. This means that the vapor above the liquid surface cools, condenses, and creates a pressure lower than that outside the tank. To equalize inside and outside pressures, air enters and mixes gradually with the vapors inside. This does not, however, prevent more vapor from escaping the next time the temperature rises, because vapor and air are a homogeneous mixture and vapor will again escape and be lost during the next temperature rise.

The next day, when the tank is completely drained, the tank space will remain filled with liquid vapor. The next time more liquid is pumped in, this vapor will then be driven out just as the initial air was.

These vapor losses may not seem important. Yet over a period of a year, this typical 20,000 bbl tank will lose a minimum of 30,000 gal. just from temperature changes, if filled with gasoline and otherwise unprotected. This is a loss of about 3.5%.

This analysis has involved only two of the four storage conditions which affect evaporation—temperature of the liquid and renewal of air over the liquid surface. The effect of the other two conditions (area of liquid surface and quantity of vapor in the surrounding atmosphere) can be better understood by looking at the simple physical phenomena that are involved in evaporation.

Evaporation makes molecules behave like this...



Molecules of any liquid are in constant motion. Some have enough kinetic energy to break through the liquid surface and escape into the space (if any) above. Thus, some portion of a liquid near its surface is continually changing into vapor. The larger the surface area, the more the molecules that can move into the space above.

In leaving the surface of the liquid, the escaping molecules must overcome two forces: 1) surface tension of the liquid itself, and 2) the opposing impingement of the vapor molecules already above the liquid surface. If the surface tension or the action of the existing vapor molecules is too great, the molecules trying to escape will not penetrate into the vapor space. And evaporation will not continue—or, at least, the number of molecules escaping the surface will equal the number forced to return to it.

This molecular pressure over the liquid is usually called "vapor pressure," because it is created by the vapor molecules that have already escaped and are flying around. The pressures of other gases or vapors also in the space may contribute to a greater total vapor pressure, but will not affect the chances of the stored liquid to escape. Vapor pressure created by one liquid does not affect the vapor pressure of another liquid—unless one liquid dissolves the other. It is governed only by the number of its own molecules that have vaporized. A practical result of this is that humidity (amount of water vapor) has no affect on the evaporation of petroleum or its products from storage tanks.

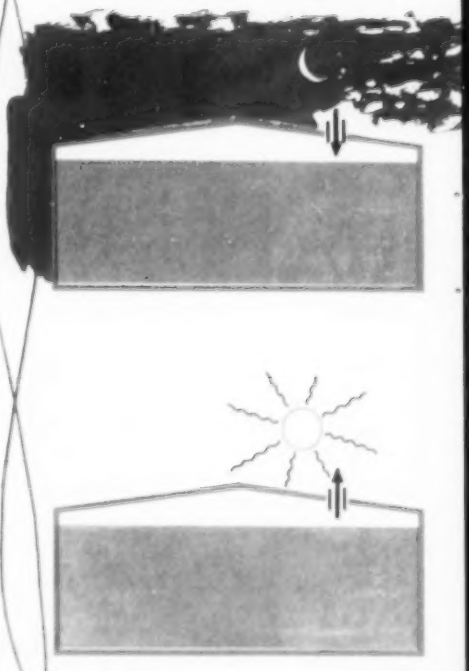
When conditions above a liquid do not permit further evaporation, the space is said to be saturated. This condition exists when the vapor pressure of the molecules leaving the liquid equals the opposing pressure of the vapor molecules already in the space above. But, remove some of the vapor above the liquid and pressure inequality will permit further evaporation—until saturation exists again.

Thus, the four storage conditions that affect the rate of liquid evaporation are: its surface temperature, surface area, amount of vapor above it, and renewal of the air above the liquid. Various combinations of these four storage conditions create the various kinds of losses, which are described in the next section.

...Now look

Storage tanks do "breathe." However, their breathing rate is, in general, once/day, or about 365 times/yr. It is caused by the daily (or hourly) variations in temperature of the vapor space and the surface of the liquid. In an open vent tank, the tank exhales whenever either of these temperatures increases. Similarly, inhalation occurs when a decrease in either temperature causes vapor in the tank to contract. The depth of this breathing varies with the time of the year, amount of sunshine, sudden atmospheric changes and other conditions which affect the temperature or pressure in the storage tank. And, each time the tank exhales it loses dollars to the atmosphere.

1—Breathing



at 5 types of **evaporation** losses

Whenever liquid is pumped into a vented tank, a certain amount of vapor is lost through physical displacement by the incoming liquid. The volume of vapor expelled is approximately equal to the volume of liquid pumped into the tank. Total losses over a year depend on the number of times the contents of the tank are replaced or "turned over." A dead-storage tank has practically no filling loss; a working tank has considerable. If the 20,000-bbl tank described before has an annual turnover of only 5, and contains gasoline of 5 psi true vapor pressure, the annual loss from filling alone is 6300 gal. If the turnover is 15, this loss is 13,650 gal.

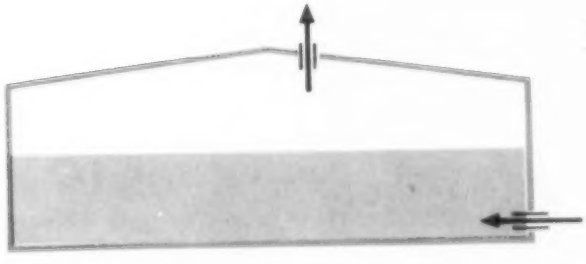
The other three types of losses: windage, wicking and wetting, make a much smaller, though significant, contribution to total evaporation loss.

Windage occurs when the wind blows across a tank, upsetting the vapor pressure balance and "sucking" saturated vapor out of the tank. **Wicking** and **wetting** occur primarily with floating roof tanks. The **wicking** loss is causing by capillary flow of liquid between the sealing shoe and the tank wall. **Wetting** loss occurs when the floating roof drops rapidly, exposing a film of liquid on the wall. In both situations, the exposed liquid is lost by evaporation.

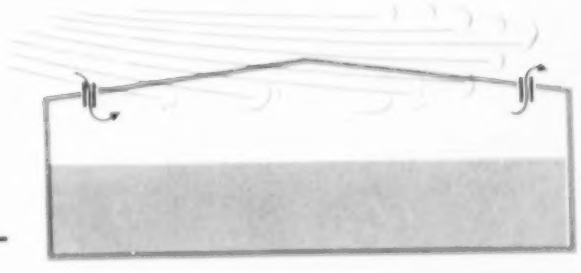
Some operating procedures may also contribute to evaporation losses because they disturb saturated vapor spaces. Gaging the liquid level in a tank through an open roof hatch allows vapor to escape. Similar vapor disturbances also permit losses, when liquid samples or temperatures are taken. Emergency maintenance work also contributes to vapor loss, because all the existing vapor is usually driven out before maintenance personnel enter the tank.

However, when vapor is blown out of a tank before personnel enter, the vapor lost is cheap insurance against potential tank damage or personnel injury.

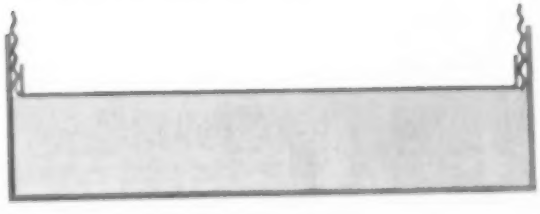
2—Filling



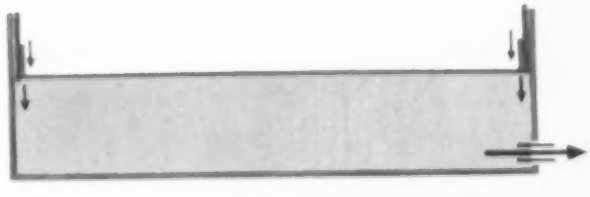
3—Windage



4—Wicking



5—Wetting



There are two basic causes of **evaporation**

Heat

Of the two, heat is the more important because it will always induce evaporation in a stored liquid. In fact, evaporation cannot exist without heat. Its main effect is to increase molecular activity, in turn creating higher vapor pressure and the escape of vapor through a relief or vent valve.

A secondary, and important, effect of heat is a physical rolling, or circulation of the stored liquid. Because of expansion and loss of the more volatile components in a given hydrocarbon mixture, heated petroleum products will circulate within a tank even though no mechanical agitation takes place. The entire contents of the tank is, therefore, at some time exposed to the vapor space, permitting the more volatile liquids to escape as vapor.

The source of evaporative heat is basically solar energy, received via two routes. 1) It may be absorbed by direct radiation from the rays of the sun, or 2) it may result from contact of the tank shell with warm surrounding air.

Heat may also be added to a tank by new liquid entering from a hot process unit. Since it is a physical fact that evaporation consumes energy (latent heat of vaporation), heat must be continually added to a system for vaporization to continue. Excluding heat will prevent further evaporation.

Pressure

Any change in the pressure of a stored liquid affects evaporation. If the pressure is increased by pumping into the tank, some vapor will condense. But, the increased pressure also will probably open a relief valve or vent, permitting some vapor to escape. Tests show that as the storage pressure is increased by 1 oz/sq in. breathing losses are decreased by 8% (at least for storage conditions below 1 psi).

...and three

Amount of Free Space

The amount of free space above the liquid surface in a tank also affects evaporation. If there is no space, as in a floating roof tank, none of the liquid will vaporize. But, if the "empty" space between the roof and liquid is large, many vapor molecules will escape into this space.

Vapor Tightness

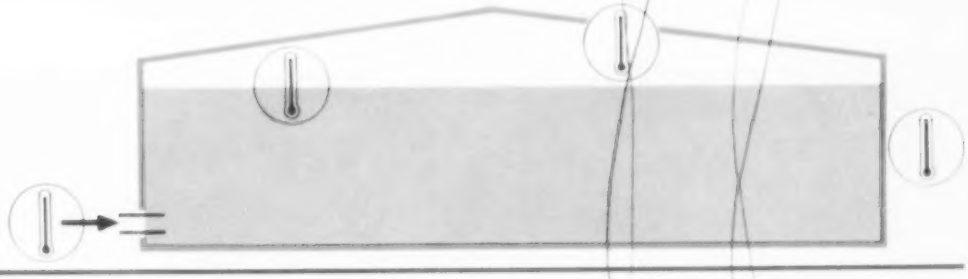
The vapor tightness of a storage tank is important too, for vapor escapes through holes, not only by pressure difference but by diffusion as well. Even though pressure may be atmospheric inside a tank, moving molecules will tend to keep going if they find no restraining shell or roof.

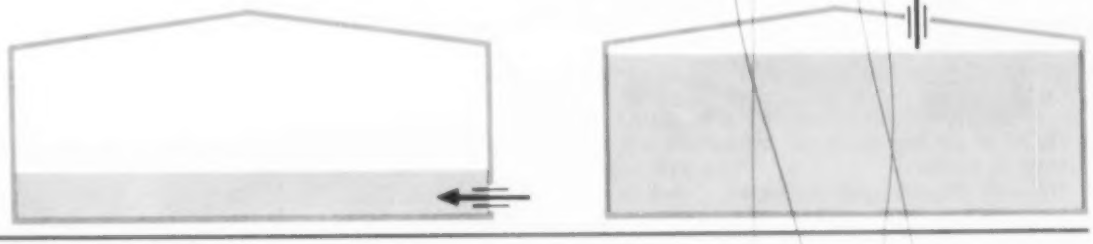
Operating Procedures

The frequency of emptying and refilling a tank also affects evaporation. If there is a long period between fillings, the entering air will become fully saturated with vapor. However, rapid working of a tank tends to reduce filling losses. If the empty-filling cycle is rapid, there may not be time for the air to become saturated. Then, the air discharged the next time will not be saturated with volatile vapors.

Pressure Conversions for Storage Tanks

Lb./sq.in.	In.of H_2O	Oz./sq.in.	Lb./sq.ft.
0.0069	0.191	0.110	1
0.062	1.73	1	8.928
0.036	1	0.578	5.198
1	27.68	16	144





secondary causes

Many types of tanks are used

Theoretically, all evaporation losses can be eliminated if a product is stored under a pressure always in excess of the product's own vapor pressure. To do this would mean using tanks capable of withstanding pressures of 25 psi and higher for many petroleum products.

But such pressure tanks are expensive. Therefore, most storage conditions are compromises between theory and practicality. The type of tank finally chosen is usually one that will save at least as much as (or preferably more than) the cost of its purchase and upkeep. Maximum desired payout period is normally two years. However, this depends on life expectancy and performance of the equipment.

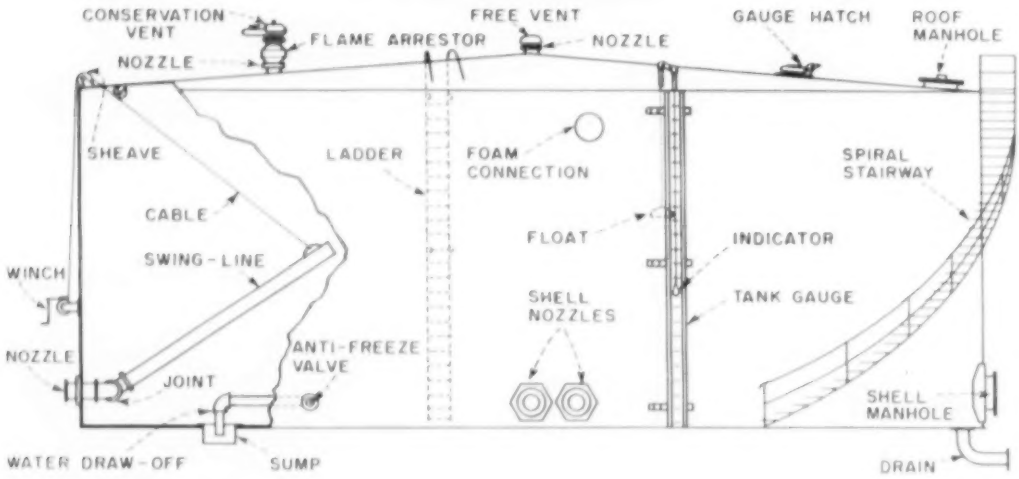
Until about 1923, all tanks were simply nothing more than large barrels. But today, many conservation-type tanks are available. These include floating roofs, lifting roofs, flexible diaphragm, and pressure tanks. All except the pressure tanks use either a movable roof or a variable vapor space to compensate for vapor fluctuations. The pressure tanks condense the otherwise lost vapors.

Steel Tank Roof Properties

Thickness	Weight, lb/sq ft	Operat. press. oz/sq. in
1/16 in. (16 ga.)	2.553	0.284
5/64 " (14 ")	3.187	0.354
7/64 " (12 ")	4.473	0.497
1/8 " (11 ")	5.107	0.568
9/64 " (10 ")	5.740	0.638
5/32 " (9 ")	6.374	0.708
11/64 " (8 ")	7.00	0.778
*3/16 " (7 ")	7.65	0.850
1/4 " (3 ")	10.20	1.133

*Minimum thickness specified by API Std. 12C

The most common type is . . . the **Fixed Roof**



Accounting for about 70% of all storage capacity today is the fixed roof storage tank. Its construction and design are well-defined by "API Standard 12C for Welded Oil Storage Tanks." Although large riveted tanks are still erected in hazardous areas, most steel tanks are welded today. Being 10-30% cheaper to construct than any of the conservation types of tanks, the fixed roof is usually adequate for storage of low vapor pressure crudes and refined products.

Although most fixed-roof tanks are classified as gas-tight, many operate with open vents. The safe operating pressure is defined by the roof weight values, as given in the table at top of page. It's possible to operate a cone roof tank at higher pressures than shown. Many tanks are, but they require structural reinforcement of the roof. If this additional expense is justified, cone-roof tanks may be operated at pressures as high as 4 oz/sq in.

Another way to increase the storage pressure of fixed-roof tanks is by weighting the roof with concrete blocks, hanging weights inside, placing a layer of water on a flat roof, or pouring a layer of concrete on top of a dome roof. This added weight may approach the snow load factor of 25 lb/sq ft, allowing storage pressures up to 2.75 oz/sq in. However, there is then no protection for any live load or snow load.

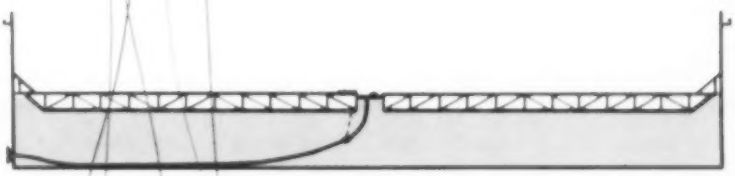
The construction of an unsupported dome or umbrella roof also permits higher operating pressures—even as high as 8 oz./sq in. There have been some industry recommendations that the API Std 12C be expanded to include construction of cone roof tanks up to 8 oz or ½ lb/sq in.

for storing petroleum

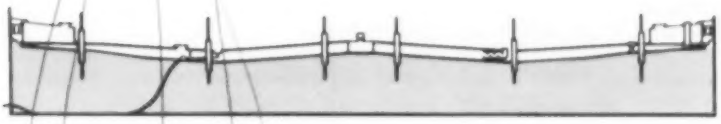
Tanks designed to cut losses include . . .

the **Floating Roof**

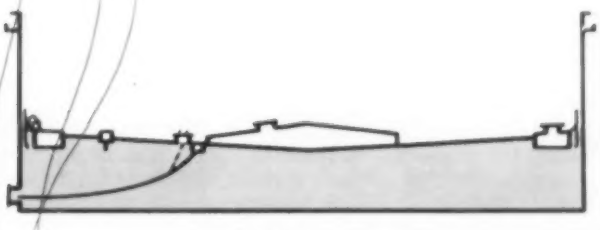
CENTER WEIGHTED



CLEAR PAN



DOUBLE CONE



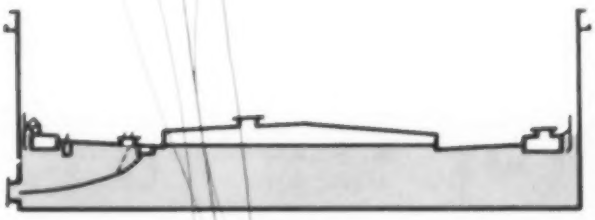
HIDEK

The earliest and most important development in conservation type storage tanks was the floating roof. A roof that floats on the surface of the stored liquid does two things. It eliminates the space required for the formation of vapor, and virtually eliminates filling losses.

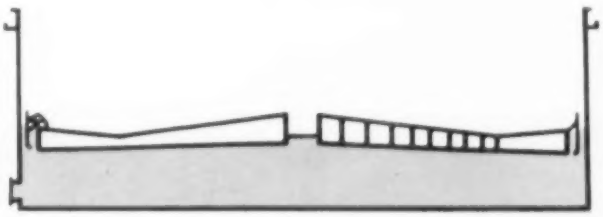
Today, the floating roof is used principally for storing any volatile product that does not boil at storage temperatures. It combats both safety hazards and economic losses. If the small vapors held within a roof seal should be ignited, the explosive pressure may be released through the vents. The flame is then snuffed out when the vent closes.

Disadvantages of the floaters stem mainly from climatic conditions. Extremely cold weather may require constant maintenance on the shoes—or even prevent using this type of tank. Also, heavy snow and ice loads may imperil operation. Special provisions must be made for draining accumulated rain down through the stored product. The presence of snow or ice loads may also affect tank gaging accuracy by depressing the roof below its normal floating position.

For list of manufacturers of patented equipment see p. 125



LODEK



DOUBLE DECK

Here are the design features of

Pan type

The earliest floating roofs, introduced some 37 years ago, were simple pans which floated on the surface of the liquid. The pan (the roof) was pitched slightly toward the center to drain collected rain water. A flexible hose permitted water to drain through the product. To prevent the flat metal pan from buckling, the top of it included many roof supports and guy wires which formed trusses.

Because of its simple construction, the pan-roof has always been subject to sharp tilting from uneven rain or snow loads. Extreme tilting, or a hole in the roof, has sunk about one out of every five simple pan-type floaters.

Another serious disadvantage of the pan-roof is its enforced contact with the surface of the liquid. For gasolines this is undesirable because solar heat, absorbed by the metal, may cause boiling of the volatile liquids. Instead of decreasing evaporation losses, this may encourage them. For reasons of stability, the pan-type floating roof is seldom used today, despite its lower construction cost.

Pontoon deck

To overcome the main disadvantages of the pan-roof—poor stability and surface boiling—pontoons were added to the exposed deck. First they were added as annular compartments and then as additions to the center deck. The added buoyancy did provide greater stability but the change in the surface contours created new roof draining problems. Some designs even created new stability problems in attempting to correct the roof draining problems. Proper design, as a consequence, has almost become more of an art than an engineering problem. This explains why many floating roofs differ, although the operating principle is the same.

The drawings illustrate the basic differences in the construction of pontoon floating roofs, including the hi-deck, low-deck, cone-deck, and centerweight deck. As shown, some are especially designed to trap vapors under the roof itself. This provides some variable vapor space conservation, as well as providing insulation from the heat absorbed by the sheet metal roof. However, the sections of the roof made of single sheet of metal still allow solar boiling.

Double deck

To gain greater rigidity and to eliminate still further any effect from solar boiling, the double-deck pontoon roof was introduced. Proper design of this type provides a continuous sloping deck plus an undersurface that may or may not be in constant contact with the liquid.

The dead-air space, trapped within the separately constructed compartments of the double deck roof is intended to provide maximum insulation from the sun's rays and reduce the rate of heat transfer to the surface of the liquid. The uniformly distributed compartments do provide greater buoyancy to the roof. Liquid or vapor that seeps into a properly welded compartment is confined to that one alone, and can be removed through a manhole on the top deck.

Because of its more intricate construction and greater use of steel, the double deck floater is the most expensive of all floating roofs, for sizes above 60 ft in diameter. Below 60 ft, double deck and pontoon decks are about the same price.

Roof seal

The most important part of a floating roof for conservation purposes is the seal around the circumference of the tank. Floaters are built with a roof diameter about 8 in. less than that of the tank shell. This permits the roof to float unrestricted within the shell. But it is important that some type of seal connects this annular gap between the shell and roof; otherwise the purpose of the tank is lost.

The seal not only prevents evaporation from this annular space but also helps to keep the roof centered within the tank shell. The conventional seal consists of metal shoes under tension against the side of the tank, and a vaporproof curtain joining the roof and the shoes. The shoes stretch the curtain over the exposed liquid and act as the sliding surface for the roof. A recent improvement is a secondary seal, or flexible curtain, which reduces the amount of vapor lost through a single seal.

Another special type of seal replaces the shoes with a scuff band. The band is held against the shell by a continuous tube filled with liquid. This design is claimed to provide a seal that conforms better to shell variations than the conventional metal shoe, and is said to eliminate completely a vapor space in the seal.

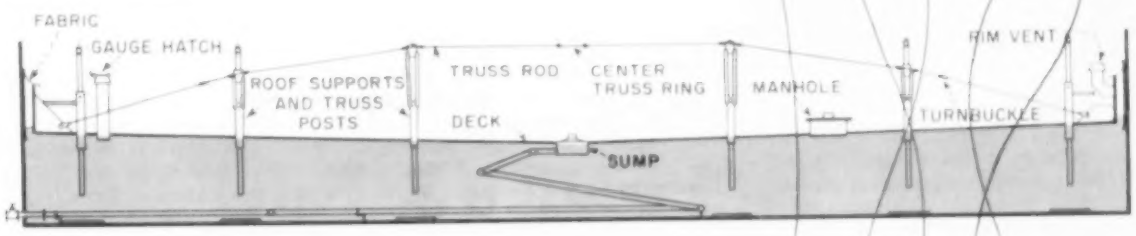
Fittings

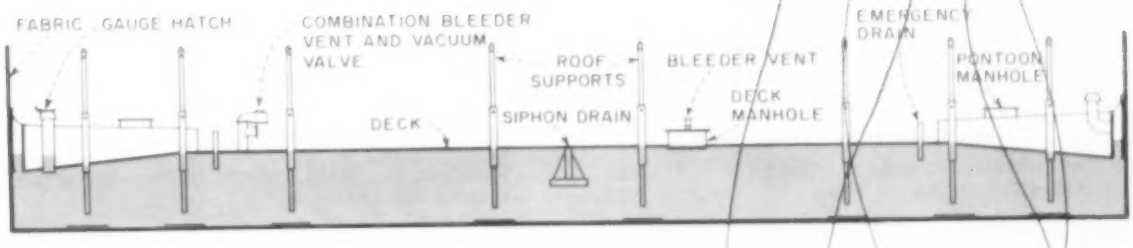
There are some tank fittings found only on floating roof tanks. These include: a hose drain, overflow and siphon drains, roof supporting legs, rolling ladder, vacuum vents, and anti-rotational guide.

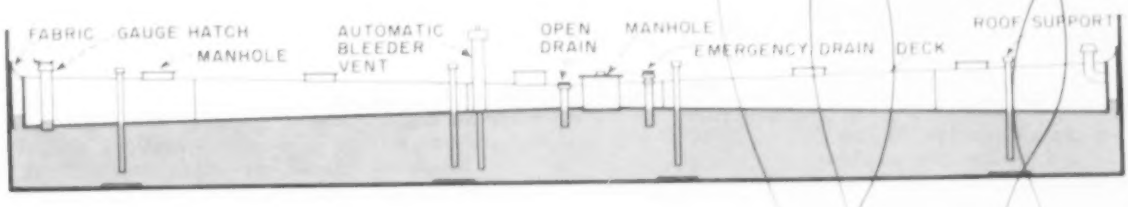
If it is not desirable to have water drained through the stored product, rain or melted snow from the roof can be conducted through the liquid and out of the tank through a special hose or swing-jointed pipe. If the water can be drained through the product to a water bottom, special overflow and siphon drains permit roof drainage without loss of stored vapors.

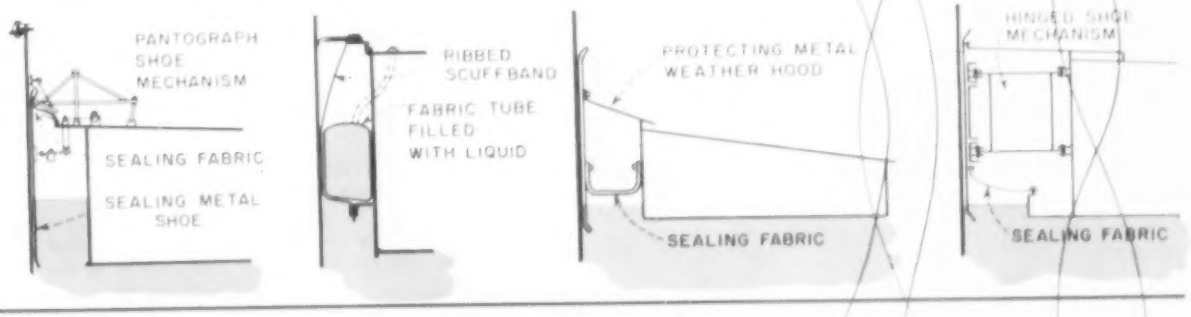
When a floating-roof tank is pumped out, it is usually not desirable to have the roof sink all the way to the bottom. This could interfere with the inlet and outlet piping, and the drain hose or pipe. In these situations, special roof support legs are adjusted from the upper deck to keep it a specified distance above the tank bottom: about 6 ft for maintenance work and 2½ to 3 ft for normal operations. If explosive vapors may exist in an empty floater, special cavities may be designed in the roof to permit lowering it completely to the bottom of the tank. This will also reduce vapor losses.

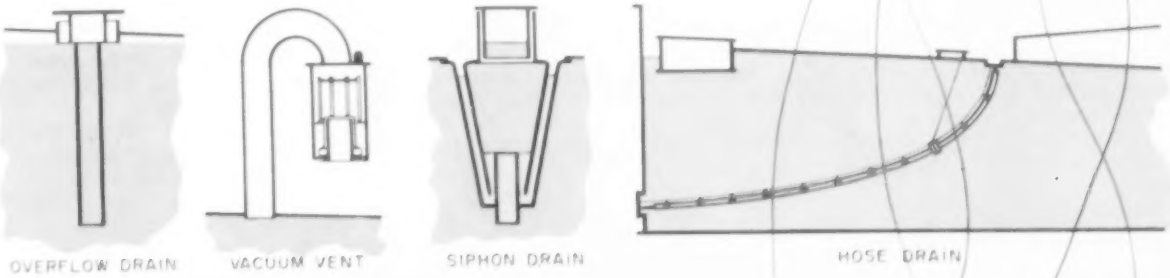
floating roofs











Conservation type tanks

Lifter roofs

Lifting roof tanks are similar to the familiar gas-holders used many years for storing produced or natural gas. Here it is the physical weight of the movable roof floating on vapor that maintains a small positive pressure, usually between 1½-4½ oz/sq. in. This method of conserving low pressure vapors normally is used with a group of inter-connected fixed-roof tanks, although a lifter may be used by itself under special circumstances.

Whenever a lifter is used as the common breathing lung for several connected fixed roof tanks, it may be necessary to reinforce the roofs. This additional expense prevents the higher operating pressure from rupturing the fixed roofs. However, tank reinforcement may be a cheaper conservation measure than the conversion of fixed roof tanks to floaters or lifters themselves. (See relative costs in the table pp. 118-119.)

Lifting roofs are designed for a vertical rise of 5, 10 or even 15 ft. When the roof reaches its maximum height, vents open and permit the trapped vapor to escape until pressure is within operating range again. The limited expansion capacity of lifter roof tanks must, therefore, be considered in scheduling pumping.

The cost of converting a fixed roof to a floating roof tank cannot be justified for many storage conditions. This is true when storage is essentially "dead" or the product turnover is very low. But some conservation measure is justified to prevent breathing losses. Lifters may often be the economic answer.

Two sealing methods are commonly used with lifters. A **dry seal** connects the roof and tank shell with a special, gas-tight fabric. Internal stabilizers and rollers assure equal movement of the roof around its circumference. A **liquid seal** lifter has a telescopic roof which rests between two concentric shells. The space between is filled with fuel oil or kerosine, with the roof section traveling up and down in this reservoir of liquid. Unless mechanically stabilized, this roof may be subject to binding, or even inoperation, if the ground beneath it settles unevenly.

. . . Flexible diaphragms

Another type of tank with a variable vapor space has a fixed roof but an internal, coated-fabric diaphragm. The diaphragm contains the vapor and rises and falls with fluctuations.

Several designs are available, all with the flexible diaphragm enclosed within a rigid shell, or tank with a fixed roof. The fixed shell or roof limits the expansion of the moving curtain. Operating pressure is lower (½ oz/sq in.) than that for the lifting roof tanks (4 oz/sq in.). Both are usually connected to a number of fixed roof tanks.

There are two basic types of diaphragm tanks: the **integrated** stores liquid as well as vapor; the **separate** type stores vapor only. The integrated diaphragm tank saves critical ground space and offers the lowest cost per unit volume of storage. The separate tank (sometimes labeled "gasholder") can recover breathing losses without alteration to existing tanks. It also offers greater service flexibility.

Because the flexible diaphragm tank does operate at a lower pressure than the lifter, it is not as efficient for controlling breathing losses. But neither is it as expensive as the lifter. For the storage of gasoline and related products, with between 3 and 10 turnovers annually, both the lifter and the variable diaphragm can be economically justified. This is especially true when the annual turnover is higher.

. . . Pressure tanks

All petroleum products which boil at normal atmospheric temperatures and pressures require pressure storage. Natural gasolines, blending stocks, and various light ends such as pentane are best stored in low-pressure tanks (½-15 psig). Unstabilized natural gasoline and LPG are best stored in pressure vessels (above 15 psig).

Theoretically, breathing losses of motor gasoline and natural gasoline can be eliminated by storing at pressures from 2½ to 15 psig. Design and construction of these tanks takes many shapes.

The simplest and lowest pressure tank is a reinforced cone or dome roof, with maximum operating pressure restricted to 2½ psi. A tank halfway between this and the round spheroid family, is the hemispheroid. Its maximum pressure is also about 2½ psig.

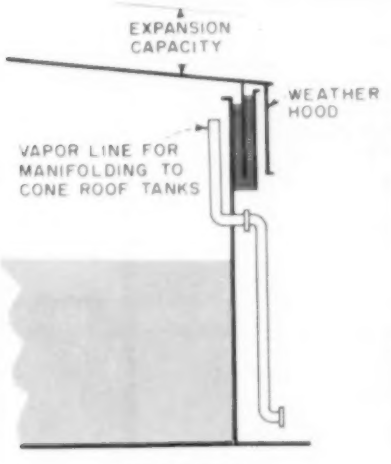
As seen in the table on pp. 118-119, the family of spheres and spheroids permits the highest storage pressures of all tanks, as high as 200 psi. However, most petroleum products found in refineries do not require this great pressure.

Spherical and spheroidal storage tanks can completely eliminate breathing losses, because compressing the contained vapor condenses it. This type tank requires no operating expenses other than ordinary maintenance. Its use is restricted, however, because of the high initial cost of fabricating tanks of complex configurations. When the spheroid tank is used for gasoline and other highly volatile products, the savings are probably a little greater than for variable vapor space tanks. And for some of the more volatile products it is the only practical method of storage.

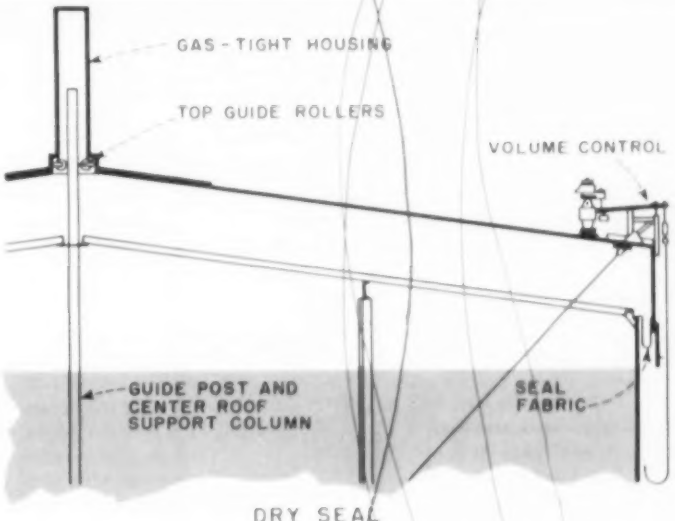
The structural shapes of spheroids depend on desired capacity and pressure. Smaller capacities and higher pressures can be handled by the smooth spheroid. If large capacities exceed the soil bearing limits, the noded spheroid is used.

For pressures above 30 psi, the spherical tank is used. Structurally, its shell is equally stressed in all directions tangential to the shell. It also has less surface area for a given capacity than a container of any other shape. For this reason it is used in critical land and space locations.

also include...



WET SEAL

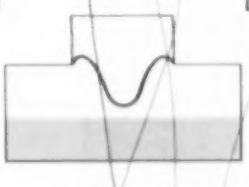


DRY SEAL

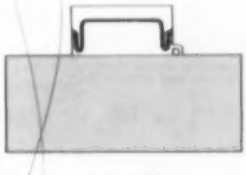
VAPORSPHERE

VAPORTANK

DIAFLOTE

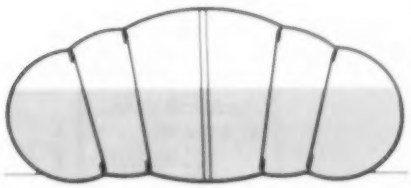


VAPOR-MIZER



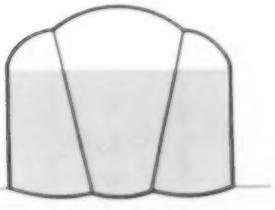
DIALIFT

PLAIN HEMISPHEROID

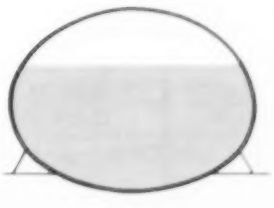


MULTIPLE NODED SPHEROID

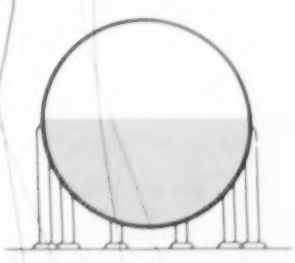
SINGLE NODED SPHEROID



NODED HEMISPHEROID

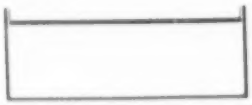
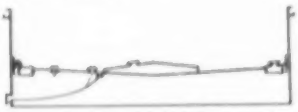
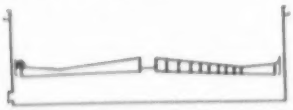


SPHEROID



SPHERE

Here's a **quick summary**

	OPERATING PRESSURE	MAXIMUM CAPACITY	RELATIVE COST	RELATIVE VAPOR LOSS BREATHING	RELATIVE VAPOR LOSS FILLING
Fixed Roof					
Standard Cone Roof	Standard Roof 1/2 oz/sq. in. Reinforced Roof 2-3 oz/sq. in.	320,000 bbl	1	10	10
Weighted Roof	8 oz/sq. in.	—	—	3	10
Floating Roof					
Pan-Type Floating Roof 	Seal vents set at 2-in. H_2O (1.16 oz/sq. in)	Largest built to date is 180,000 bbl	1.10 to 1.20	2	3/4
Single Deck Pontoon Roof 			1.25 to 1.33		
Double Deck Pontoon Roof 			1.35 to 1.50		
Lifting Roof					
Standard Floating Roof	4 oz/sq. in.	80,000 bbl	5 Ft. Lift: 1.45 10 Ft. Lift: 1.65	1	9
Special Expansion Roof (Steel diaphragm)	4 oz/sq. in.	140,000 bbl	1.1		
Diaphragm					
Floating Membrane	1/2 oz/sq. in.	320,000 bbl	For given capacities, relative costs are: cu. ft. 20,000-1.70 35,000-1.60 50,000-1.30 100,000-1.35	1	7
Breathing Diaphragm		Integral Tank: 110,000 cu. ft. Ground Tank: 150,000 cu. ft.			
Weighted Diaphragm Vapor Container		81,000 cu. ft. 150,000 cu. ft.			
Pressure					
Plain Hemispheroid Noded Hemispheroid	Plain: 15 psi Noded: 2 1/2 psi	20,000 bbl 30,000 ubl	1 1/2-2	1/2	7
Plain Spheroid Noded Spheroid	Plain: 50 psi Noded: 20 psi	40,000 bbl 120,000 bbl	3-5	1/2	0
Sphere	30 to 217 psi	30,000 to 1,000 bbl	5-10	1/2	0

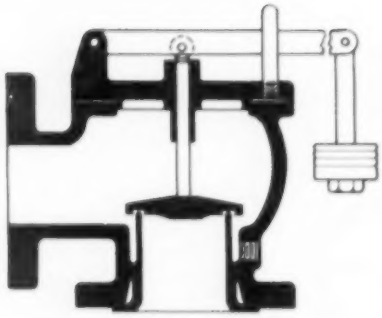
Relative costs are based on 80,000 bbl capacity, unless noted otherwise. Relative vapor losses are compared only within the vertical columns. The values for "breathing" and

# of tanks ... and what they can do

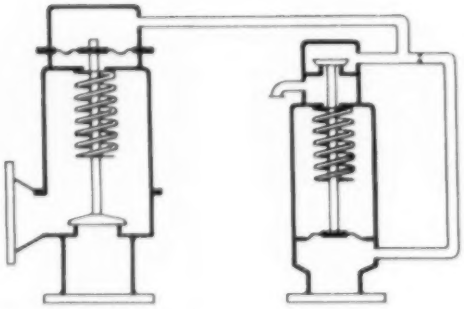
	PRINCIPAL USE	ADVANTAGES	DISADVANTAGES
	Diesel Oil Lube oil Kerosine (not jet fuel) Low sulfur crude Gasoline (by some)	1. Least expensive.	1. Permits breathing and filling losses. 2. May contain explosive mixtures.
	Low volatiles – up to 12 Rvp	1. Provides a low pressure tank with minimum expense.	1. Corrosion shortens life of roof, if water layer used. 2. More expensive, if internal support required. 3. Will not support an additional snow load, or live load.
	Sour crude Heavy stocks with low volatiles Gasolines Napthas Volatile crudes Jet fuels	1. Least expensive floater (for sizes over 10,000 bbl). 2. Controls breathing and filling losses. 3. Reduces roof corrosion. 4. Reduces fire hazard. 5. Largest water storage capacity.	1. Unstable and sinkable. 2. Poor drainage. 3. Difficult operation in cold climate. 4. Permits maximum heat transfer from roof to liquid. 5. Limited load carrying ability.
		1. Stable. 2. Reduces roof corrosion and fire hazards. 3. Greater load carrying ability (than pan-type). 4. Reduces solar boiling.	1. More expensive (than pan type). 2. Difficult cold weather operation. 3. Permits some heat transfer from roof to liquid.
		1. Stable. 2. Reduces solar boiling. 3. In special cases (storage of 15-18 Rvp) greater roof weight may prevent evaporation.	1. Most expensive floater. 2. Difficult operation in cold weather.
	For storage of volatile products, having low throughput	1. Reduces breathing, and some filling losses. 2. Can serve as a breathing lung for several fixed roofs. 3. Easy maintenance in cold weather.	1. Small effect on filling losses, especially for a single tank. 2. Costs more to operate than a cone roof. 3. Necessary to strengthen cone roofs if connected to this type tank.
	Motor gasoline at low throughput Interconnected systems, where income and outgo are about equal Aviation gasoline In snow country, where operation of lifting roofs is critical	1. Can be mounted on existing fixed roof tank (first two types). 2. Eliminates (almost) breathing loss. 3. Cost of construction may be lower than comparable lifter.	1. Some small diffusion of vapors through the diaphragms. 2. Operating experience over many years is not yet available.
	Motor gasoline Blending stocks	1. Least expensive low pressure tank. 2. Eliminates (almost) breathing loss. 3. Operates well in cold climates. 4. Adequate for most gasolines.	1. More expensive than fixed roof tanks.
	Natural gasoline Blending stocks	1. Will prevent losses of volatile products.	1. More expensive.
	Butane Pentane Propane Hexane Volatile natural gasoline	1. Needed to store high volatiles in liquid form.	1. Most expensive.

filling are not comparable, one with the other. * When operated within a pressure range – not at one pressure only.

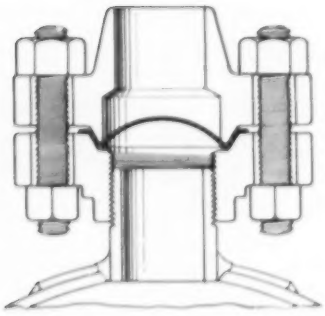
Equally important are the **tank accessories**...



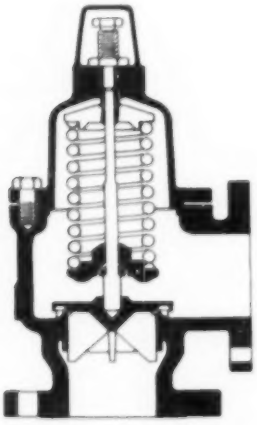
WEIGHT – LOADED



PILOT – OPERATED



RUPTURE DISC



SPRING – LOADED

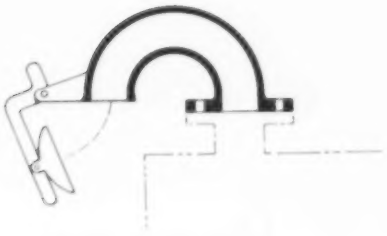
Valves

Relief valves are safety devices for any tank or vessel that operates under pressure. They are not designed to control evaporation. But, leaking safety valves can be a cause of evaporation losses.

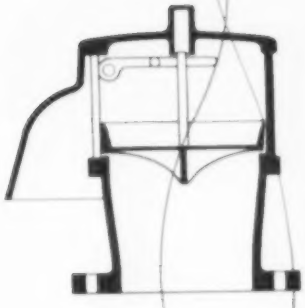
If an emergency relief valve opens (because of high internal pressures), vapor escapes. The vapor lost is usually a cheap insurance to pay for the protection of the tank and the operating personnel. But, if the relief valve fails to reseat at the proper pressure, it may be a constant source of loss.

Most relief valves operate like the conservation vent. An overpressure will lift the valve from its seat, with the valve continuing to open as the pressure increases.

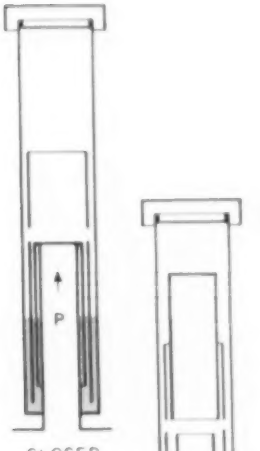
To overcome this long and unnecessary opening-shutting period, a special liquid-seal valve was introduced several years ago. Called the "burp" valve because of its characteristic operating sound, it is now under controlled testing in a number of installations. Instead of a long open-shut period, this valve relieves the pressure in one large burst, and then is positively closed with a liquid seal.



FREE VENT (with snuffer)



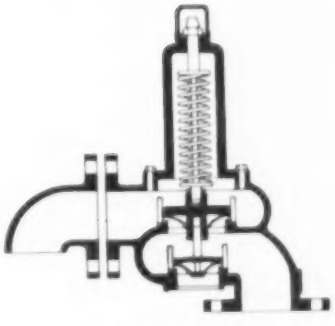
PALLET LOADED



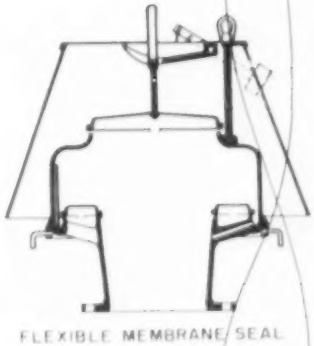
CLOSED

OPEN

LIQUID SEAL



PRESSURE - VACUUM
(spring loaded)



FLEXIBLE MEMBRANE SEAL

Vents

Vents are necessary on fixed-roof tanks to permit breathing and filling without collapsing or bursting the tank. Two types are used: the open-vent and the conservation-vent valves.

Known as the "gooseneck," the normal open vent is nothing more than a hooded opening. It has a protective screen, normally turned down so that it will not be blocked by ice or snow. This type of vent is required by API safety standards for tanks having products with a flash-point over 100°F. But it offers no protection against evaporation losses.

A special conservation-vent valve does control evaporation loss somewhat. It normally starts to open at ½ oz/sq in. pressure, or a vacuum of 0.2 oz/sq in. This operating range of less than 1 oz/sq in. only reduces breathing losses—it does not eliminate them.

Most vent valves are held closed by an adjustable weight. When a small overpressure develops, the weighted pallet or valve, starts to rise off its seat. At maximum operating pressure the valve is full open, allowing rated venting. Setting the operating pressure higher than the conditions stated in the table on pp. 112 may weaken the tank roof by lifting the plates off the supporting girders. However, in some situations, these lifting pressures might be set higher than now specified to attain evaporation control.

Vent-valve design varies with each manufacturer. But they are all designed so that safe tank pressure or vacuum will not be exceeded under any possible operating condition.

Because fire can exist at the discharge of either the open or conservation vent, when flammable gases flow through them, hinged snuffers are often added. These can be operated from the ground.

Another safety fixture sometimes added to fixed-roof vents are flame arrestors, designed to prevent a flame traveling back into a tank. But, because flame arrestors reduce the exhausting capacity of vents, and may clog, some refiners do not use them.

There are four other ways to

1—Cover the liquid

Conversion of a fixed roof to either a lifter or floater is expensive. A less costly alternative is to cover the surface of the liquid with something similar to a floating roof.

Early attempts included layers of shredded cork, pink-pong balls, chemical foam, and other flexible blankets that would float on the surface. A monomolecular film of surfactant is one of the latest suggestions still in the laboratory stage.

Two methods now being used are Microballoons and a plastic blanket.

. . . with microballoons

These are small plastic spheres, about 1/1000 the size of ping-pong balls. The center is filled with inert gas. Made from either a phenolic or an urea-formaldehyde resin, these spheres float on the surface of the liquid in the form of a blanket. A ½-in. layer in static crude tanks has reduced evaporation losses in some cases by 85%. A 1-in. layer on the surface of stored gasoline has cut evaporation by 50%.

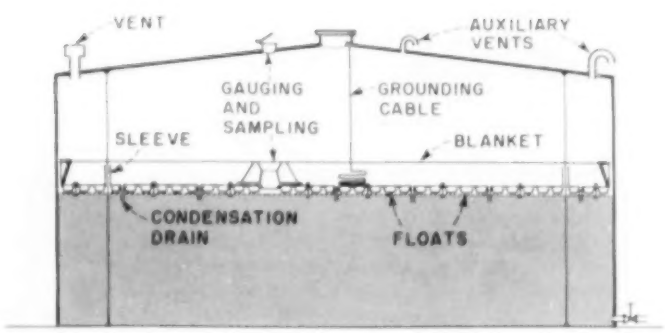
The efficiency of a layer of these new Microballoons will increase with age. Initially, the rate of evaporation may even increase because of greater exposure of liquid surface. But as the lighter ends evaporate, the heavier residues which remain on the surface of the spheres permit close packing and the formation of a real vapor barrier.

All the limitations and advantages of Microballoons are not yet known. Test results so far show that they may deteriorate if in constant contact with water. To prevent this, initial coating of the surfaces with oil by mixing prior to their introduction into a storage tank is recommended. Special precautions must also be observed in agitating tanks containing Microballoons. However, the potential of these small spheres for controlling evaporation in special cases is currently under intensive testing.

. . . with a plastic blanket

Another surface covering undergoing trial today is a plastic blanket of pure polyvinyl chloride. Supported by hollow plastic floats made of the same sheeting, it floats on the surface of the stored liquid. Thus, it acts as a floating roof within an existing fixed roof tank.

In early tests, the blanket reduced evaporation losses by 80 to 90% for crude oil and gasoline storage. It is currently being tried principally in foreign refineries, although one company in the U. S. is testing it in two working tanks.



The plastic blanket has several special features: a stainless-steel cable prevents static charges; the blanket is made in segments which are easily inserted in rolled condition into a tank—and then zippered together; and openings are provided for gaging and sampling. A flexible Z-shaped skirt seals the edge of the blanket against the side of the tank.

As with Microballoons, the plastic blanket may create explosive mixtures in the space above it—or, it may eliminate this storage condition. Extra vents in the roof above the blanket are suggested to preclude any explosive mixture.

One of the limiting factors in the use of this blanket may be the size of the tank. Larger tanks with supporting columns and cross beams will restrict the movement of the floating blanket, or increase the chance for evaporation through many special openings.

reduce **evaporation** losses

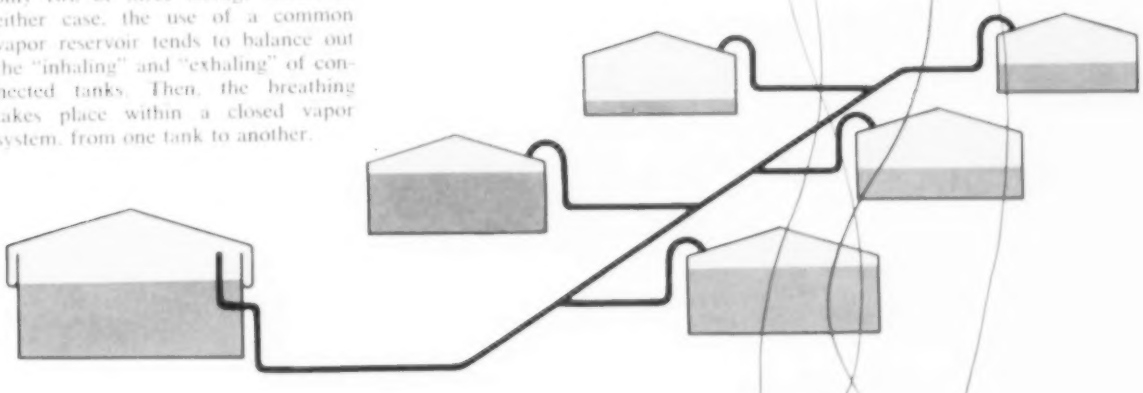
2—Contain the vapor

Most storage tanks emit vapor because of uncontrollable or atmospheric operational conditions; therefore, why not just collect and save all the vapor expelled? Again, it is a matter of economics.

Two systems now in use, vapor-recovery and vapor-balancing, do contain the otherwise lost vapors. The basic difference between the two is in the use of a compressor in the vapor recovery system.

. . . using vapor balance

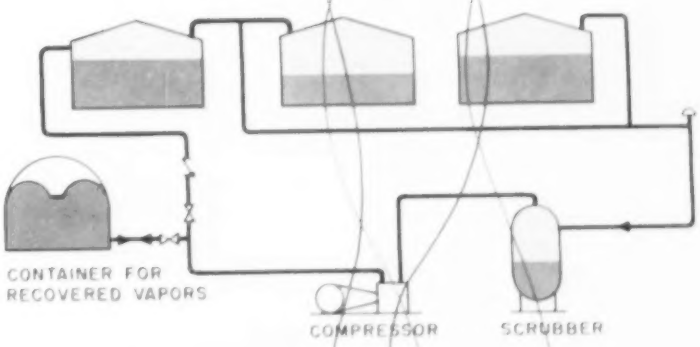
In the vapor balancing system, several fixed-roof tanks are connected by vapor piping to a common "breathing" tank. This may be a special vapor housing that handles up to 20 tanks, or a "lifter" that takes care of only two or three storage tanks. In either case, the use of a common vapor reservoir tends to balance out the "inhaling" and "exhaling" of connected tanks. Then, the breathing takes place within a closed vapor system, from one tank to another.



. . . using vapor recovery

A vapor recovery system, used on more volatile products, actually liquefies the vapor which would otherwise escape. A compressor "pulls off" vapors from a storage tank before they create enough pressure to open a vent valve to the atmosphere. The liquefied vapors are thus conserved and reinjected into the same or other stored products.

Both types of vapor-saving systems require a manifold of vapor lines. In some situations these may be 6, 8 or 10 in. lines to allow low pressure drops. The cost of these installations depends on many factors, all of which enter into the economic justification for these systems.



There are four other ways to reduce **evaporation** losses...

3—Reduce the breathing

Another way to attack evaporation loss from storage tanks is to minimize the conditions which cause it. This includes several physical alterations to the tank to prevent absorption of pressure-causing heat.

The most obvious way is to insulate the storage tank from outside heat sources. Painting the outside of the tank will reduce the heat caused by sunshine or solar radiation. In fact, many tests have shown that painted storage tanks will have 30-40% less vapor loss than unpainted tanks. And the color, type and coverage of paint will affect the loss, as shown in the accompanying table.

Effect of Paint on Tanks

Type of Surface	% Reduction in Breathing Losses
No paint	0
Black paint	0
Light gray	12
Aluminum (weathered)	20
White (chalking)	40

Another method used in sunny locations is to erect a sun shade over the storage tank itself. Especially designed for materials with low flash points, this method insulates the tank from rays of the sun by an air blanket.

Rigid or castable insulation applied to the outside of tanks will reduce the heat energy conducted through the walls or roof of tanks. The temperature variation in the vapor spaces and the surface temperature of the liquid are then both lowered. Naturally, where refrigeration of the stored product is used (see below), insulation on the tank will improve efficiency of the system.

Another method of preventing evaporation is to remove heat, either from the tank itself or its contents. Spraying the tank with water in hot climates cools the tank by evaporation of the outside water film. A thin layer of water on the roof will do the same job. However, both procedures usually increase maintenance and corrosion on the tank exterior. And in many hot climates, water may be too expensive.

When products go to storage from a hot process unit, most of the heat content is removed through heat exchangers before pumping into the tank.

In other situations, heat may be continually removed from a storage tank by refrigeration of the product through its own evaporation. If the pressure in a butane storage tank, for example, is lowered by removing a portion of the vapor, more vapor will form immediately. Heat then is absorbed from the remaining liquid or the tank itself, thus lowering the entire heat content of the tank and its product.

4—Keep the tank closed

If a storage tank contains volatile vapors, every tank opening means not only an economic loss but a safety hazard as well. Most refineries have reduced these problems to a minimum by installing remote level reading and sampling devices. The use of flow meters instead of measuring tanks has also reduced the need for tank gaging. This eliminates the filling losses associated with measuring-tanks.

Better maintenance, the use of corrosion inhibiting agents, and better steel material have reduced the number of times that storage tanks must be opened for inspection or corrective maintenance. Small though they are, these factors all make contributions to vapor loss.

Proper planning and production schedules can also reduce evaporation losses. If fixed-roof tanks are kept as full as possible, there will be little free space in which vapor can form. A desirable and attainable goal is to keep tanks above a 50% full level.

Theoretically, it is also possible to take advantage of the daily breathing cycle by proper scheduling. If a product is pumped into a storage tank during the cool hours, a natural vapor balance system can be utilized. Refinery scheduling can seldom be this flexible; however, it is a goal to be kept in mind.

Rapid turnover of a working tank will also cut down evaporation losses. The shorter the period of standing between pumpings, the lower will be the concentration of oil in the oil-air vapor space. When the tank then is filled the vapor loss will be less.

Don't forget—

safety's

a factor too

Escaping petroleum vapors represent not only economic losses but also potential safety hazards.

Typical Explosive Mixtures

Product	% Limits in Air Lower	Upper
Acetylene	2.5	80.0
Benzene	1.4	7.1
Butane -n	1.9	8.5
iso-Butane	1.3	8.4
Butadiene	2.0	11.5
Butylene	1.7	9.0
Ethane	3.0	12.5
Ethylene	3.1	32.0
Gasoline	1.4	7.6
Heptane	1.2	6.7
Hexane	1.2	7.5
Hydrogen	4.0	75.0
JP-4	4	20
Kerosine	1.2	6.0
Methane	5.3	14.0
Octane	1.0	—
Pentane-n	1.4	8.0
iso-Pentane	1.3	—
Propane	2.2	9.5
Toluene	1.3	7.0
Xylene	1.0	6.0

The table above shows that every petroleum product has a certain air-mixture range in which explosion is possible. These explosive ranges must be kept in mind whenever petroleum products are stored in closed containers. A primary goal of all storage conditions, besides preventing losses to the atmosphere, should be to prevent the evaporated liquids from existing in an explosive air-vapor range.

Here's a quick way to **estimate losses**

"This "quick method" permits a rapid and approximate estimate of evaporation losses from existing cone roof storage tanks.

Step 1. Obtain the breathing loss from the curve, right. (This curve is the result of observations made over many years of tank design and construction.)

Step. 2. Assume filling loss is 1/6% of throughput.

Step 3. Add together the filling and breathing losses, Step 2 and Step 1. This total is your loss for any specific period.

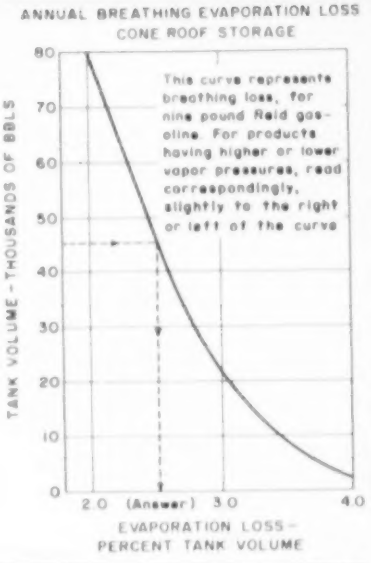
(This method was developed by one of the large tank manufacturers for quick loss-estimates, and is based on many experience factors).

IF YOU WANT TO CHOOSE A CONSERVATION TANK, follow up with these:

For:	With:	Consider:
Low Turnovers	Low pumping losses	Lifters, or flexible diaphragm tanks
High Turnovers (over 8/yr)	Unbalanced pumping	Floating roofs
High Turnovers (over 8/yr)	Balanced pumping	Lifters, or flexible diaphragm roofs

Remember these facts:

1. A lifter can service at least one additional tank of the same capacity, or several smaller ones.
2. Flexible diaphragm tanks can be sized for any group of tanks. The cost is proportional to capacity.
3. A floating roof serves only itself.
4. Estimated expansion capacities are: 10% for less than 25,000 bbls. 7½% for larger tanks.



Who Makes It?

(A Ready-Reference to trade-named tanks and surface coverings.)

Floating Roof Seals	
"Horton Seal"	Chicago Bridge & Iron Co., Chicago, Ill.
Sealing Mechanism	Wyatt Metals & Boiler Works, Houston, Tex.
"Tubeseal"	Hammond Iron Works, New York, N. Y.
"Vapor-Stop"	Graver Tank & Mfg. Co., E. Chicago, Ind.
"Wiggins Safety Seal"	General American Transportation Corp., Chicago, Ill.
Floating Roofs	
Center-Weighted	Graver Tank & Mfg. Co., E. Chicago, Ill.
"Horton" Roofs	Chicago Bridge & Iron Co., Chicago, Ill.
Twin Deck	Wyatt Metals & Boiler Works, Houston, Tex.
"Wiggins Lodek"	General American Transportation Corp., Chicago, Ill.
"Wiggins Hidek"	
Lifting Roofs	
Expansion Roof	Graver Tank & Mfg. Co., E. Chicago, Ill.
Lifter Roof	Bethlehem Steel Co., Bethlehem, Pa.
"Vapor-Lift"	Hammond Iron Works, New York, N. Y.
"Wiggins Dry Seal"	General American Transportation Corp., Chicago, Ill.
Diaphragm Tanks	
"Diaflote"	Hammond Iron Works, New York, N. Y.
"Dialift"	
"Hortondome"	Chicago Bridge & Iron Co., Chicago, Ill.
Horton Vaporsphere	
Horton Vaportank	
"Vapor-Mizer"	Graver Tank & Mfg. Co., E. Chicago, Ill.
Low Pressure Tanks	
"Globe Roof"	Hammond Iron Works, New York, N. Y.
Hemispheroid	Chicago Bridge & Iron Co., Chicago, Ill.
High Pressure Tanks	
"Hortonsphere"	Chicago Bridge & Iron Co., Chicago, Ill.
"Hortonspheroid"	
"Graversphere"	Graver Tank & Mfg. Co., E. Chicago, Ill.
"Cylindroid"	Graver Tank & Mfg. Co., E. Chicago, Ill.
Surface Coverings	
"Microballoons"	Patented by Standard Oil Co. (Ohio) Produced by: Bakelite Co., New York, N. Y. Colton Chemical Co., Cleveland, Ohio
Plastic Blanket	LaRoche Freres, Paris, France W. K. Archer Co., Kansas City, Mo.

Want More Information?

"How to Reduce Evaporation Losses," Manual WP 14, General American Transportation Corp, 1953.

"Evaporation Loss of Petroleum from Storage Tanks," Symposium of the American Petroleum Institute, November, 1952, Chicago, Ill.

"Petroleum Tankage & Transmission," by H. L. O'Brien, Graver Tank & Mfg. Co., 1951.

"Evaporation Losses of Aviation Gasoline in Standing Storage," Bureau of Mines Publication RI 3701, May, 1943.

"Conservation in Petroleum Storage," by D. E. Larson, General American Transportation Corp., 1948.

"Evaporation Losses—How To Reduce Them," by Esso Standard Oil Co., *National Petroleum News*, July 13 and 27, 1949.

"Applied Methods and Equipment for Reducing Evaporation Losses of Petroleum and Gasoline," by Ludwig Schmidt for Bureau of Mines, 1937.

"Evaporation Losses from Cone Roof Tanks," by R. C. Ulm, Graver Tank & Mfg. Co., 1946.

"Effect of Paint Colors In Reducing Storage-Tank Losses," by E. L. Hoffman, an API paper presented in San Francisco, November, 1955.

"New Vent Valve Cuts Vapor Losses," PETROLEUM PROCESSING, January, 1954, pp. 62-64.

"Foam Floating Roof Pays Off," PETROLEUM PROCESSING, December, 1953, pp. 184-188.

"Rapid Pay-Off in Saving Vapors," PETROLEUM PROCESSING, March, 1949, pp. 249-253.

The author wishes to express his appreciation to the individuals in the following companies, who were so generous with their time and knowledge in supplying background information for this special report:

Aluminum Co. of America
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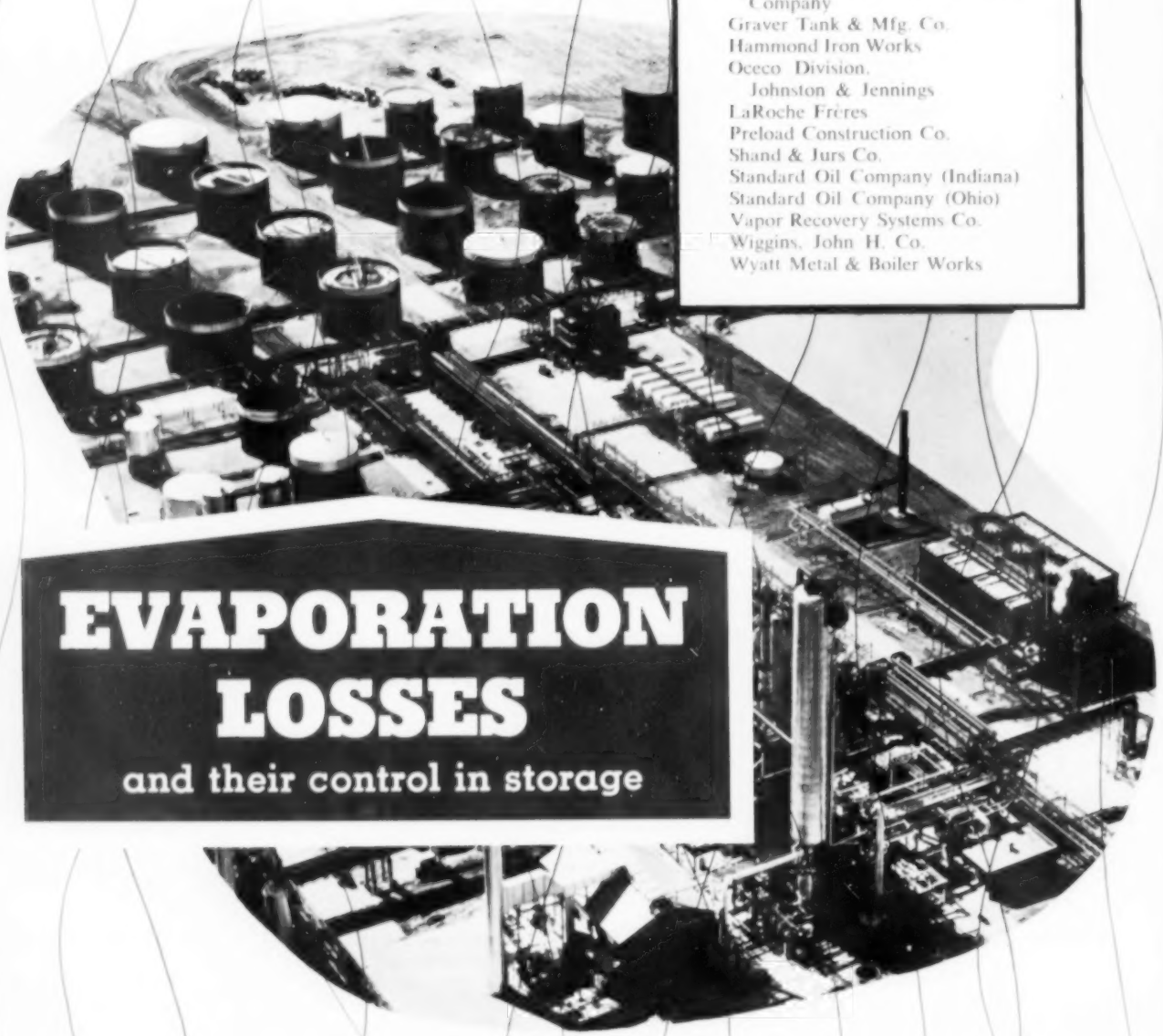
Black, Sivalls & Bryson, Inc.
Chicago Bridge & Iron Co.
Colton Chemical Co.
Esso Standard Oil Co.
General American Transportation Company
Graver Tank & Mfg. Co.
Hammond Iron Works
Oceco Division,
Johnston & Jennings
LaRoche Frères
Preload Construction Co.
Shand & Jurs Co.
Standard Oil Company (Indiana)
Standard Oil Company (Ohio)
Vapor Recovery Systems Co.
Wiggins, John H. Co.
Wyatt Metal & Boiler Works



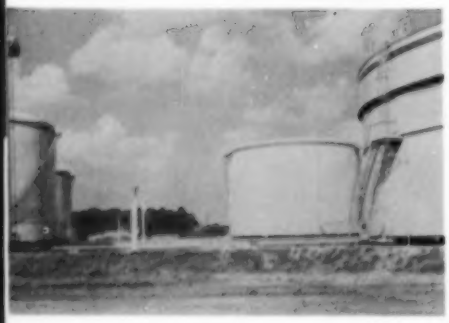
EVAPORATION LOSSES

and their control in storage

GRAVER

case histories of
low terminal losses

GRAVER

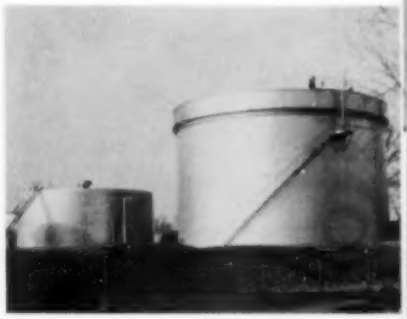


Georgia "A"—Temperature 61.2—Loss 0.17%

Texas "B"—Temperature 66.0—Loss 0.21%

Wisconsin—Temperature 51.0—Loss 0.13%

Mississippi —Temperature 67.0—Loss 0.10%



Kentucky—Temperature 53.1—Loss 0.21%

Case histories of random samples of successful control of terminal losses . . .

Loss of product means loss of profit. Graver has engineered its Expansion Roof Tank design to hold this loss to a minimum. The substantiation of this claim is evident in the case histories of the many Graver Expansion Roof Tank® systems in service since 1939.

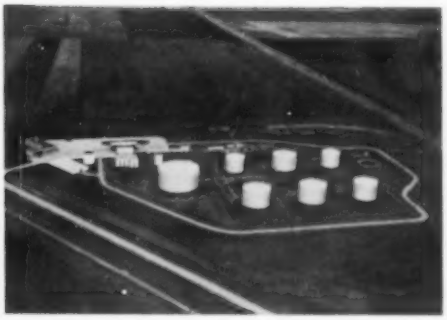
Here are random samples—and averages from them. Compare your average annual temperatures. Compare your percentage terminal losses. Evaporation contributes greatly to terminal loss. The less the evaporation, the greater the profit.

If your terminal losses are a matter of sober reflection, it is likely that Graver Expansion Roof Tankage can do a lot to improve your profit picture.

GRAVER TANK & MFG. CO., INC.

East Chicago, Indiana

CHICAGO • NEW YORK • PHILADELPHIA • EDGE MOOR, DEL. • PITTSBURGH • DETROIT
TULSA • SAND SPRINGS, OKLA. • HOUSTON • LOS ANGELES • FONTANA, CAL. • SAN FRANCISCO



Minnesota—Temperature 44.3—Loss 0.03%

Georgia "B"—Temperature 61.2—Loss 0.21%

Alabama—Temperature 65.0—Loss 0.23%

New York "C"—Temperature 48.3—Loss 0.10%

GRAVER

Tennessee "A"—Temperature 61.8—Loss 0.22%

SAMPLINGS OF TERMINAL LOSSES

LOCATION	ATMOS. AVE TEMP.	YEARLY THRUPUT (GALS.)	YEARLY TURNOVERS	EXP. ROOF OR CLOSED SYSTEM	% LOSS OF THRUPUT
Temperature Zone "A"					
Minnesota	44.3	4,675,005	11	Exp. rf. syst.	0.03
Temperature Zone "B"					
New York "A"	48.1	7,000,000	5	Exp. rf.	0.18
New York "B"	48.3	10,000,000	12	Exp. rf. syst.	0.09
New York "C"	48.3	10,000,000	5	Exp. rf. syst.	0.10
Massachusetts	49.6	48,000,000	5	Exp. rf. syst.	0.15
New Hampshire	49.6	28,000,000	4	Exp. rf. syst.	0.08
Iowa	50.1	5,000,000	6	Exp. rf.	0.05
Ohio "A"	50.3	24,000,000	16	Exp. rf. syst.	0.15
Average	49.1			Average	0.11
Temperature Zone "C"					
Wisconsin	51.0	46,000,000	10	Exp. rf. syst.	0.13
Ohio "B"	53.1	40,000,000	10	Exp. rf. syst.	0.09
Kentucky	53.1	12,000,000	10	Exp. rf.	0.21
Average	52.4			Average	0.14
Temperature Zone "D"					
Pennsylvania	54.4	10,700,000	9	Exp. rf. syst.	0.06
Illinois	55.9	9,600,000	10	Exp. rf.	0.28
Missouri	55.9	5,000,000	4	Exp. rf. syst.	0.09
Average	55.4			Average	0.14
Temperature Zone "E"					
Georgia "A"	61.2	57,000,000	17	Exp. rf. cyst.	0.17
Georgia "B"	61.2	17,000,000	40	Exp. rf.	0.21
Georgia "C"	61.2	41,000,000	16	Exp. rf. syst.	0.11
Georgia "D"	61.2	18,000,000	13	Exp. rf. syst.	0.17
Tennessee "A"	61.8	29,000,000	11	Exp. rf. syst.	0.22
Tennessee "B"	61.8	20,000,000	25	Exp. rf.	0.18
Tennessee "C"	61.8	30,000,000	21	Exp. rf.	0.13
Average	61.4			Average	0.17
Temperature Zone "F"					
Alabama	65.0	7,000,000	6	Exp. rf. syst.	0.23
Texas "A"	66.0	15,000,000	8	Exp. rf. syst.	0.25
Texas "B"	66.0	17,000,000	36	Exp. rf.	0.21
Virginia	66.9	5,739,000	7	Exp. rf. cyst.	0.22
Mississippi	67.0	2,500,000	15	Exp. rf.	0.10
Louisiana	68.0	10,700,000	5	Exp. rf. syst.	0.21
Average	66.4			Average	0.20

More case histories of control over terminal losses through Graver Expansion Roof Tanks

Tennessee "B"—Temperature 61.8—Loss 0.18%

New Hampshire—Temperature 49.6—Loss 0.08%

Louisiana—Temperature 68.0—Loss 0.21%

Georgia "D"—Temperature 61.2—Loss 0.17%

GRAVER®

GRAVER TANK & MFG. CO., INC.

East Chicago, Indiana

CHICAGO • NEW YORK • PHILADELPHIA • EDGE MOOR, DEL. • PITTSBURGH • DETROIT • TULSA
SAND SPRINGS, OKLA. • HOUSTON • LOS ANGELES • FONTANA, CAL. • SAN FRANCISCO

Corrosioneering News

Quick facts about the services and equipment Pfaudler offers to help you reduce corrosion and processing cost.

Published by The Pfaudler Co., Rochester, N.Y.

Get continuous centrifuging in your continuous processes

For *continuous removal* of solids from one or two liquids . . .

For *continuous concentration* of solids by removal of liquid from slurries . . . and discharge of solids in a predetermined dry state . . .

It is no longer necessary for your centrifuging to be an expensive and time-consuming "batch" type operation.

While rotating at full speed, the Titan Superjector Centrifuge discharges solids deposited within the centrifugal bowl and thus cleans itself.

How it works

A simple yet unique design enables the Superjector to work automatically like no other centrifuge.

Solids are discharged through peripherally placed slots. These slots periodically are opened and closed by a telescopic action actuated by hydrostatic pressure. This pressure is built up by centrifugal force.

The concentration of solids and clarity of liquid produced can be adjusted within wide ranges. Solids can easily be concentrated to as low as 40% moisture content. Liquids can be rendered crystal clear.

If you can see uses for such an automatic centrifuge in your operations, write for your free copy of Bulletin No. 930, "Titan Superjector Centrifuge." Or ask your Pfaudler representative for details.

Now—fastest drying of corrosive products with Pfaudler dryer-blender

How do you go about drying highly corrosive products in your plant?

If you're not using a Pfaudler conical glassed steel dryer-blender you may be spending too much time and money on this process.

4-day drying yield ready in 7 hours... reported one user making product containing acid halides. Filling and emptying the Pfaudler conical glassed steel dryer-blender is quick and easy. It has a 1½ foot diameter opening for filling and a single 8 inch discharge nozzle for the 4 ft. and 6 ft. units.

Most of the labor cost and time previously spent handling trays of vacuum dryers is saved.

When in use, the dryer slowly revolves, tumbling its contents and quickly providing an evenly blended, evenly dried product.

These structural features built into the unit make it your fastest and most economical tool for drying and blending highly corrosive products:

- Solid one-piece construction of inner vessel for maximum strength, greatest corrosion resistance and easiest cleaning.
- Space between inner vessel and spherical portions of jacket heads insures effective drying with no waste of heat.
- No joints or clamps to break up the drying surface area. This heated surface area is maximum; therefore drying time is shortest.

At Eastman Kodak Company this Pfaudler dryer-blender, used for drying a corrosive organic halide, has reduced time required by previous methods (4-6 days) by 75%.

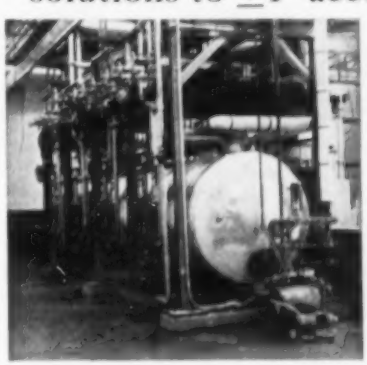
- Vacuum exhaust tube is located up and out of the product while the unit is in operation. There it is able to remove vapors most efficiently.

Dries acids and alkalies

You can use Pfaudler conical dryer-blenders for every acid except hydrofluoric and for alkalies up to pH12 at 212° F. Thus you get the same flexibility you are already familiar with in Pfaudler glassed steel reactors.

These dryers range in volume up to 165 cu. ft. working capacity. They are available in four different diameters: 2 ft., 4 ft., 6 ft., and 8 ft. Internal pressures may range from full vacuum. Each unit is tested to meet ASME code specifications. Write for Data Sheet 26.

How Sylvania heats, cools four separate solutions to ±1° accuracy . . . in one system



The problem at Sylvania Electric Products, Inc. was to find a system that would hold four different solutions to within 1° F. of a predetermined temperature. These solutions may be required for use between 55° and 70° at any time, and are supplied at anywhere from 38° to 78° F.

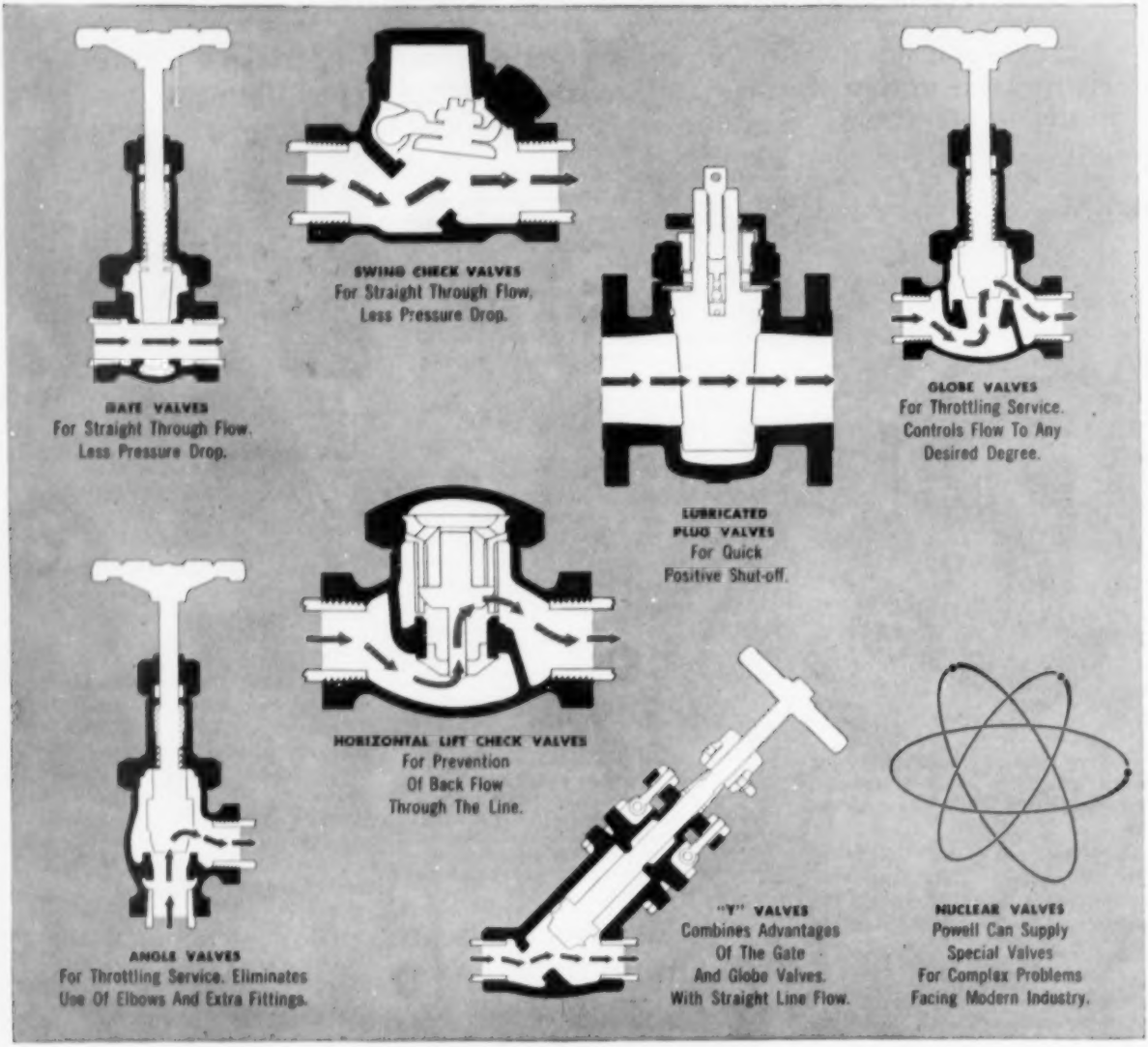
Thus, the system must either heat the solution or cool it. It must also vary the degree of heating or cooling. It must switch from heating to cooling, depending on change of set point.

Now in operation at Sylvania's Seneca Falls, N. Y. plant is the Pfaudler system shown (left). It does all the thermal gymnastics mentioned, and still holds to within 1° accuracy on all four solutions.

This system, completely designed and equipped by Pfaudler, includes heat exchangers, all control valves, the heating equipment, refrigeration equipment, automatic controls, panel board and all auxiliary equipment. It is typical of the type of project engineering Pfaudler now offers.

(To obtain more data on advertised products see page 178)

POWELL
for all valve needs



for every flow control problem there is a right Valve

Powell can supply this right valve—*made right* of the right material*. Every part of every valve must pass rigid inspection. And as a final step in manufacture, every Powell Valve has *Performance Verified* through an *actual line test.*

As an aid in selecting the right valve, the basic valve designs are illustrated here. For complete information on the wide range of sizes and materials available in each type of the basic valves illustrated above, consult your Powell Valve distributor. If none is located near you—or if you have a special flow control problem—write direct to The Wm. Powell Company, Cincinnati 22, Ohio.

PERFORMANCE
PV
VERIFIED

The Wm. Powell Company, Cincinnati 22, Ohio . . . 110th YEAR

POWELL VALVES

*BRONZE, IRON, STEEL AND CORROSION RESISTANT VALVES

Oronite LUBE OIL ADDITIVES provide

Rust protection

Performance under all types of operation

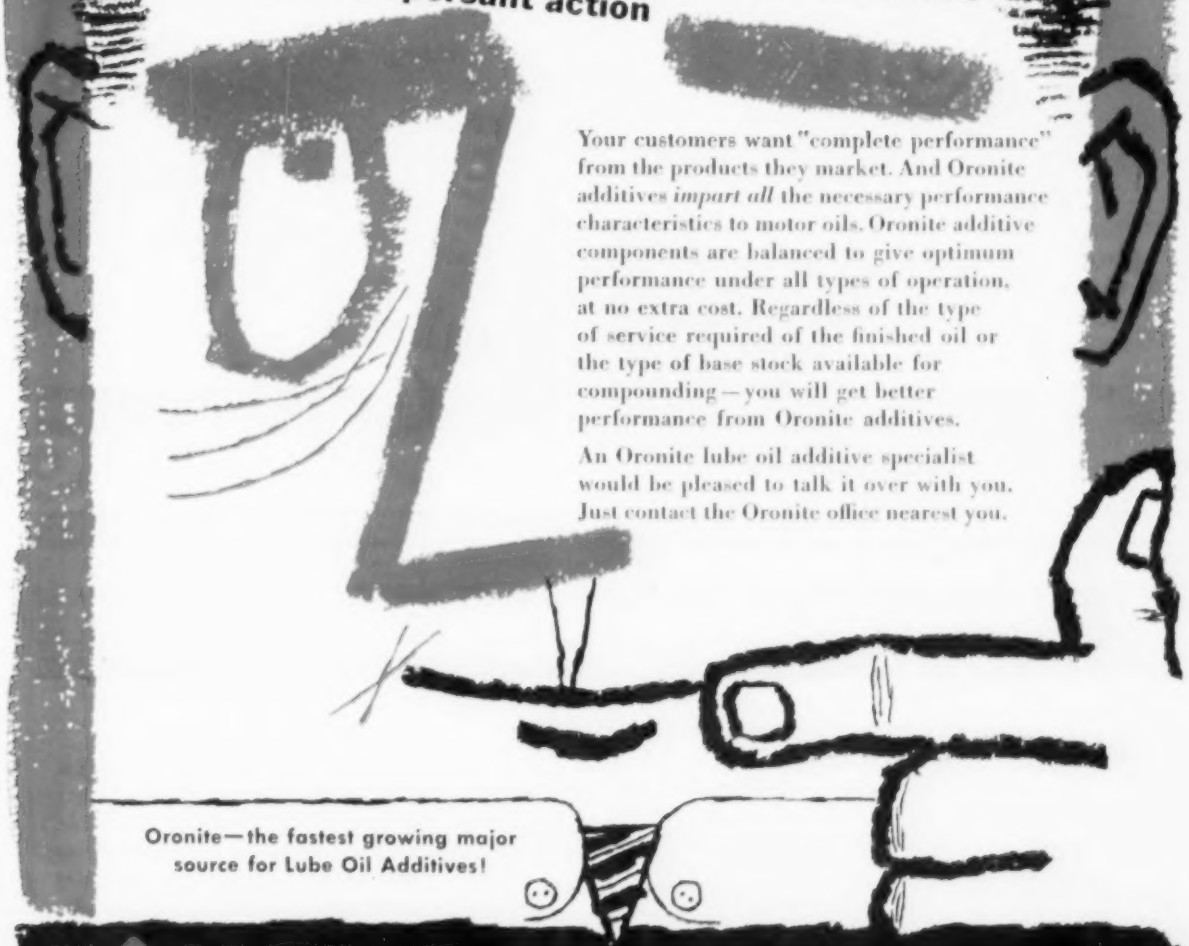
Reduced engine wear

Corrosion protection

Engine cleanliness

Oxidation resistance

Detergent-dispersant action



Your customers want "complete performance" from the products they market. And Oronite additives *impart all* the necessary performance characteristics to motor oils. Oronite additive components are balanced to give optimum performance under all types of operation, at no extra cost. Regardless of the type of service required of the finished oil or the type of base stock available for compounding—you will get better performance from Oronite additives.

An Oronite lube oil additive specialist would be pleased to talk it over with you. Just contact the Oronite office nearest you.

Oronite—the fastest growing major source for Lube Oil Additives!

ORONITE CHEMICAL COMPANY

ORONITE CHEMICAL COMPANY

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SALES OFFICES

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Carew Tower, Cincinnati 2, Ohio — 714 W. Olympic Blvd., Los Angeles 15, Calif.

36 Avenue William-Favre, Geneva, Switzerland

(To obtain more data on advertised products see page 178)

. . . 54 pages on —

TABLE OF CONTENTS

- Uses
- Physical properties—tables and graphs
- Chemical properties
- Specifications
- Handling and storage
- Physiological properties
- Shipping specifications
- Analytical procedures
- Bibliography

Write on your letterhead for this new book—and for samples of our material. It's the purest available commercially—free of impurities that cause corrosion and interfere with reactions. Stocks nationwide. Technical service—no obligation.

Dept. EA 1-20-1

Allied Chemical — NITROGEN DIVISION

40 Rector Street, New York 6, N. Y.

Ethanolamines • Ethylene Oxide • Ethylene Glycols • Urea • Formaldehyde • U. F. Concentrate—85 • Anhydrous Ammonia • Ammonia Liquor • Ammonium Sulfate • Sodium Nitrate • Methanol • Nitrogen Solutions • Nitrogen Tetroxide • Fertilizers & Feed Supplements

(To obtain more data on advertised products see page 178)

Your Guide to . . .
Petroleum Processing Departments

Keep Your Data File Up-to-Date

"Clip-n-File" Process Data —

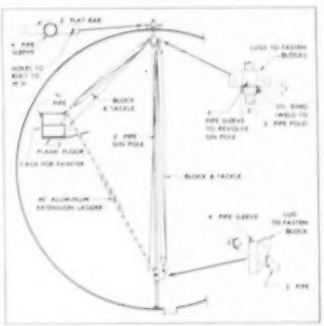
Lube Oil Improvement

. . . by Thermofor Continuous Percolation in clay bed. Socony Mobil process. p. 139

"Clip-n-File" Engineering Data —

Vapor Pressure

. . . what it is, how it's measured. Including a chart of vapor pressure for gasoline and other products. p. 151



Practical Interior Scaffold

Here's a scaffold that saves valuable maintenance time in work on spherical tanks. It can be raised and lowered quickly, and from one setting permits workmen to reach any spot on a six-foot-high swath in a spherical tank. For more details and more Plant Practices see p. 143

Patent Describes New Boron Source

Novel organo-boron compositions can be made by passing a free oxygen-containing gas through a normally liquid paraffinic fraction of 350 to 800 F boiling point. This patent is extra significant because of the attention being given boron as an octane booster. To keep yourself up-to-date on new developments turn to p. 159

Are You Watching the Trends?

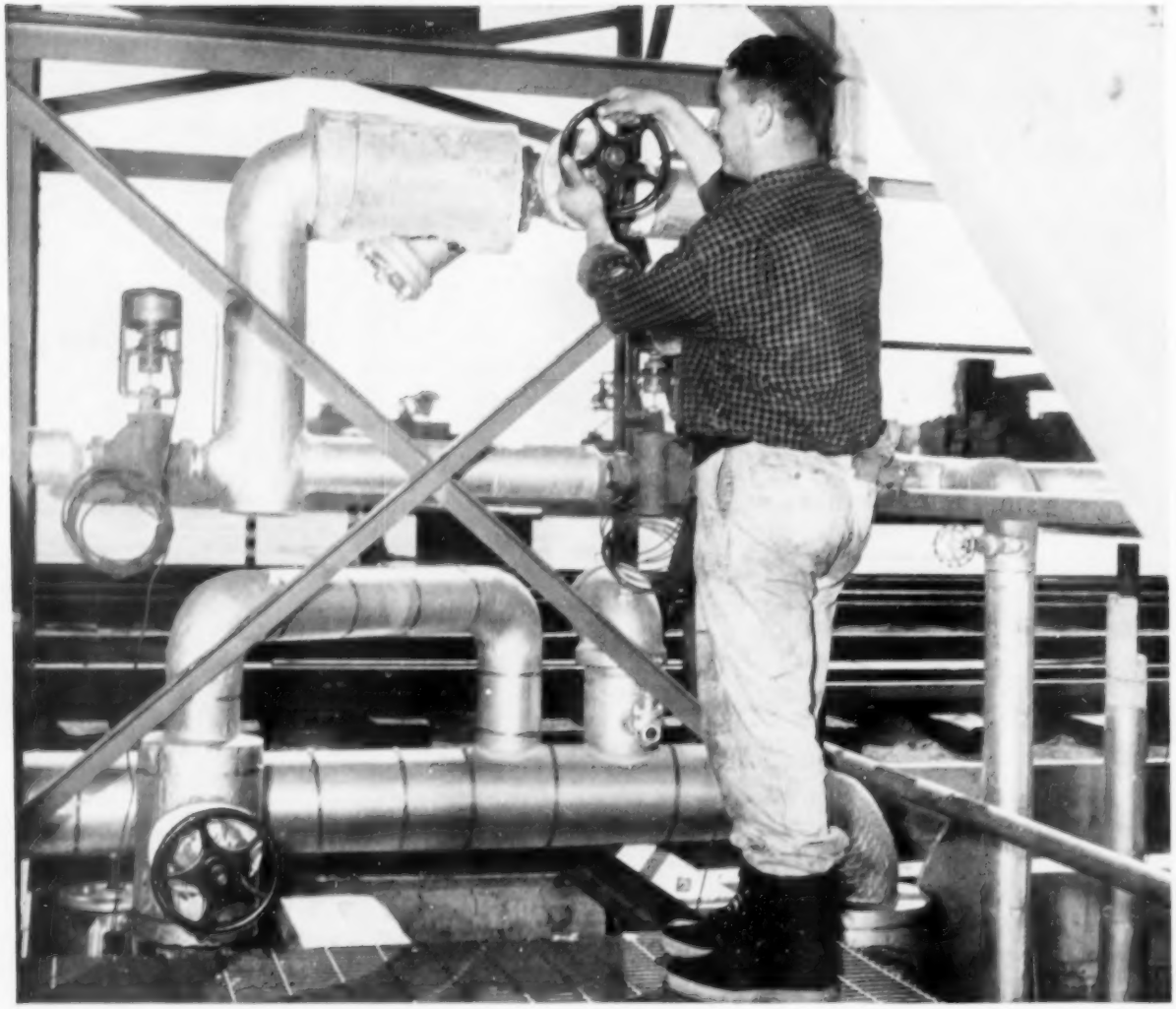
Keep abreast of the current statistics each month on crude runs to stills, product output, supply, and demand data. Turn to Operating Trends. A helpful feature now included is a "target" on the charts showing adequate stocks at critical dates ahead. p. 173

Clear Packaging is Versatile

This plastic is strong, resistant to oil and corrosive fluids, chemically inert, and suitable for packaging most lube oils, drugs, and corrosive chemicals. Read about this new item and many others in What's New in equipment and products starting on p. 181

INDEX TO DEPARTMENTS

Advertisers' Index	178
Book Reviews	171
Editorials	212
Engineering "Clip-n-File" Data	151
Equipment — What's New!	181
Information Offered	176
Meetings for Oil Men	157
New Words in Your Reading	149
Operating Trends	173
Patents	159
Personals	153
Plant Practices	143
Process "Clip-n-File" Data	139
Readers' Service Card	179
Statistics — Operating Trends	173
Suppliers News	167
What's New!	181



He not only washes tank cars... he doesn't contaminate them

Even a good washer can contaminate a product tank car unknowingly—it all depends on the valves in the washing system.

But that doesn't happen at the Memphis emulsifiers plant of the Atlas Powder Co.

Here, Crane 18-8 SMo stainless steel valves are preventing corrosion and resultant iron pickup from getting into aluminum or stainless steel cars in washing. Such impurities could mean a lot of spoiled product when the cars are loaded.

After more than a year's service on hot detergent solution, the Crane alloy valves show no corrosive effects, and there's no record of damage from iron contaminants. With no maintenance whatever, the valves continue giving positive flow control.

New Crane alloy valves are helping all types of process industries with better flow control and higher contamination corrosion resistance at low cost. They offer many service features that can't be duplicated. Get full information from your local Crane Representative or write to address below. Ask for circular AD-2080.

CRANE VALVES & FITTINGS

PIPE • KITCHENS • PLUMBING • HEATING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

START HERE

Process—Improving color and stability of lubricating oils and waxes by continuous percolation in clay bed.

Process Flow—Oil to be decolorized is preheated and introduced into the bottom of the percolation tower (see schematic flow diagram) through a multi-nozzle distributor. The product oil is taken overhead through a blotter press to remove traces of entrained clay. The product oil is then steam stripped, dehydrated, cooled and sent to storage.

Regenerated clay from the kiln (15/30 mesh Fullers Earth) is fed into the top of the percolator and distributed over the cross-section of the tower through a number of feed legs. The clay falls through the oil in the settling zone and merges with the clay bed. The rate of clay feed is adjusted to give the desired product color.

The spent clay is withdrawn from the bottom of the percolator through a multi-pipe drawoff system. The pipes terminate in a collector pot beneath the percolator. A seal leg transfers the spent clay from the bottom of the collector pot to the inlet of a lift pipe. The clay slurry flows up the lift pipe to an appropriate cross-over connection, which discharges into the wash tower feed leg. About an equal volume of oil is discharged from the tower with the spent clay.

The spent clay in the wash tower is washed counter-currently with naphtha in an operation similar to the percolation step. The naphtha-oil solution taken overhead is charged to a stripper where the naphtha and oil are separated. Stripped oil is recycled to the percolator with the fresh feed, and the naphtha is returned to the wash system.

Washed clay, containing some naphtha, enters a steam-coil heated drier from which dry clay (free of naphtha) is withdrawn continuously. The naphtha vapor from the drier is condensed and recycled to the washing system.

The dry spent clay is regenerated in a conventional Thermofor clay-burning kiln with elevators used for transporting the clay. Adsorbed color bodies and oily materials are burned under controlled conditions in the kiln. Specially designed heat transfer coils, containing molten heat transfer salt, are used to control the temperature in the burning zone, thereby avoiding overheating. Regenerated clay is cooled and passed back to the percolator and reused.

Charge Stocks—The range of stocks processed to date include light neutral, heavy neutral and bright stock. These stocks have been processed for production of both motor oils and turbine oils.

Process Variables—Processing of such a variety of stocks calls for wide flexibility in adjusting clay to oil ratio. Typical data on rates and product yields obtained on the stocks mentioned above are shown in Table 1. In producing motor oils, product rates of 4200 b/d have been obtained on light neutral and 3250 b/d on heavy neutral, with a 30 ton/day clay circulation rate.

Product Yields—For processing typical charge stocks are given in Table 1 for Middle East Oils.

Operating Conditions—For the preceding charge stocks and products are given in Table 1.

Utilities—Average utilities and chemicals consumption for 1955 operations are presented in Table 2.

Installations—Two commercial units are presently in operation at Coryton, England (Mobil Oil Co., Ltd.), and Pernis, Holland (Royal Dutch Shell).

Licensor—Socony Mobil Oil Company, Inc., 26 Broadway, New York 4, N.Y.

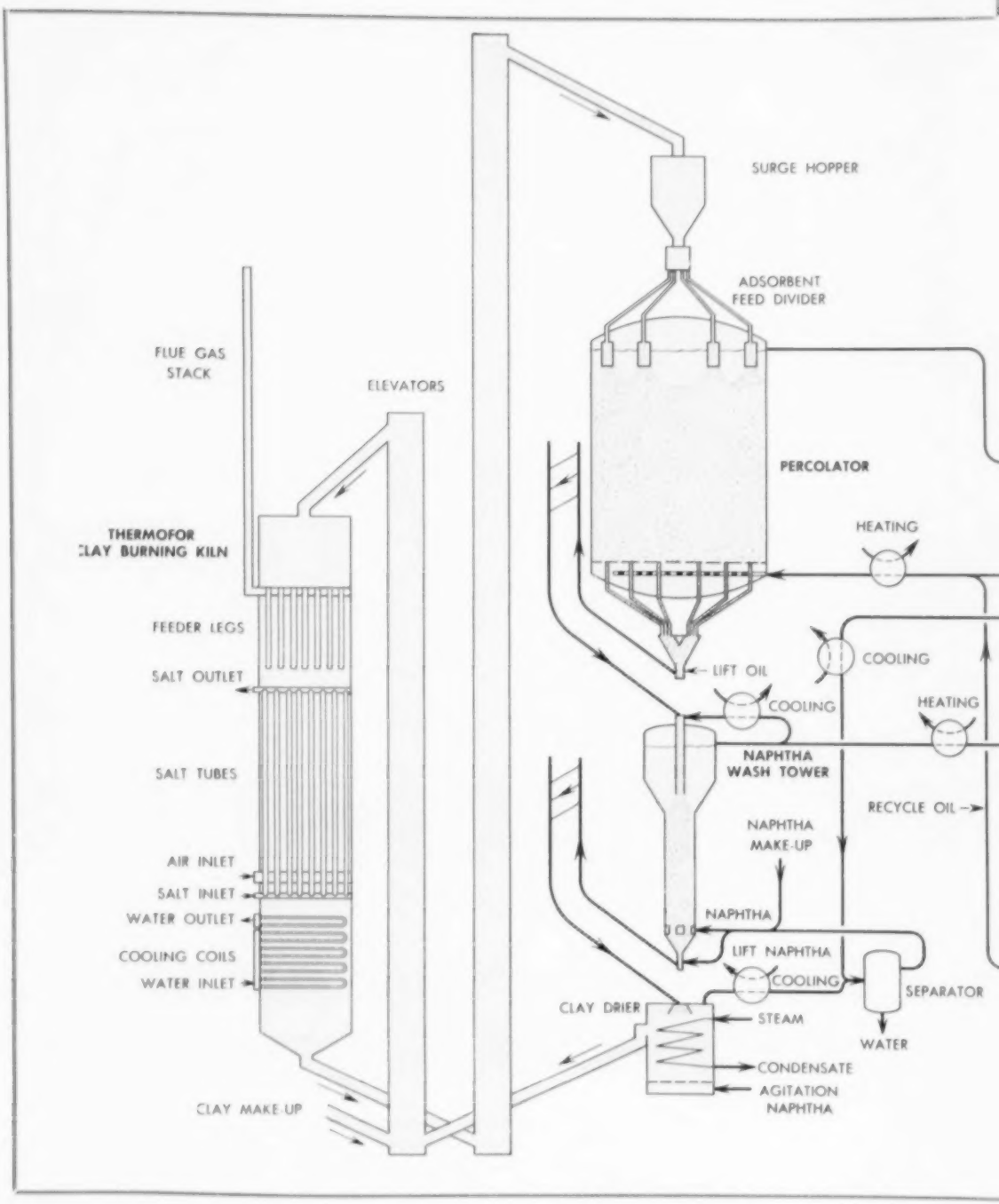
Table 2—Average Utilities and Chemicals Consumption for TCP Unit (1955)

Utilities	
600 psig steam, lb./bbl. charge	123
125 psig steam, lb./bbl. charge	63.9
Cooling water, I.G./bbl. charge	1111
Fuel Gas (FOE), bbl./1000 bbl. charge	3.86
Kerosine (FOE), bbl./1000 bbl. charge	1.36
Electric Power, kwh/bbl. charge	1.98
Chemicals Usage	
Fullers Earth, lb./bbl. charge	0.64
Solvent Naphtha, bbl./1000 bbl. charge	3.59

Table 1—Commercial TCP Operating Data for Typical Middle East Oils

Stock	Light Neutral		Heavy Neutral		Bright Stock	
Product Type	Motor	Turbine	Motor	Turbine	Motor	Turbine
Product Rate, b/sd	4200	1600	3250	1900	2100	550
Product Rate, b/sd/sq ft	20.5	9.7	19.4	11.5	18.2*	15.5**
Clay Rate, tons/sd	30	56	30	59	54	38
Operating Temperature, °F	250	210	295	310	356	360
Operating Viscosity, cp	3.8	4.9	2.8	3.2	4.5	4.5
Charge Color, ASTM	3—	2½—	5—	4—	6—	6—
Product Color, ASTM	2½—	1—	4½—	2½—	5—	3—
Charge Viscosity:						
Saybolt Sec. @ 100°F	145/155	145/155	350/400	350/400		
Saybolt Sec. @ 210°F				150/160	150/160	150/160
Product Yield, bbl/ton	140	28.6	110	32.2	39	14.5

*Superficial rate increased with 900 b/d of product recycle.
**Superficial rate increased with 2000 b/d of product recycle.
NOTE: This corresponds to product yields of 140 and 110 bbl./ton, respectively. When running light and heavy neutrals for turbine oils, oil rates were 1600 and 1900 bpd, while clay rate was 56 ton/day. Bright stock turbine oil was produced at a rate of 550 bpd.



References—Articles published about the TCP process and the Thermofor kiln include:

(1) Anon., "The Thermofor Continuous Percolation Process," *World Petroleum*, 25 (7) 38 (1954).

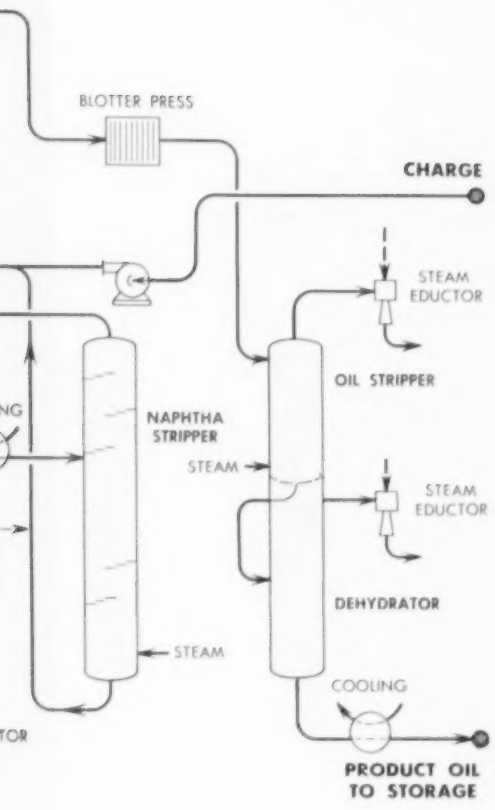
(2) Evans, L. P., K. E. Magin, J. J. Savoca and H. W. Shea, "Thermofor Continuous Percolation," *Proc. American Petroleum Institute*, 33 (No. 3) 79 (1953).

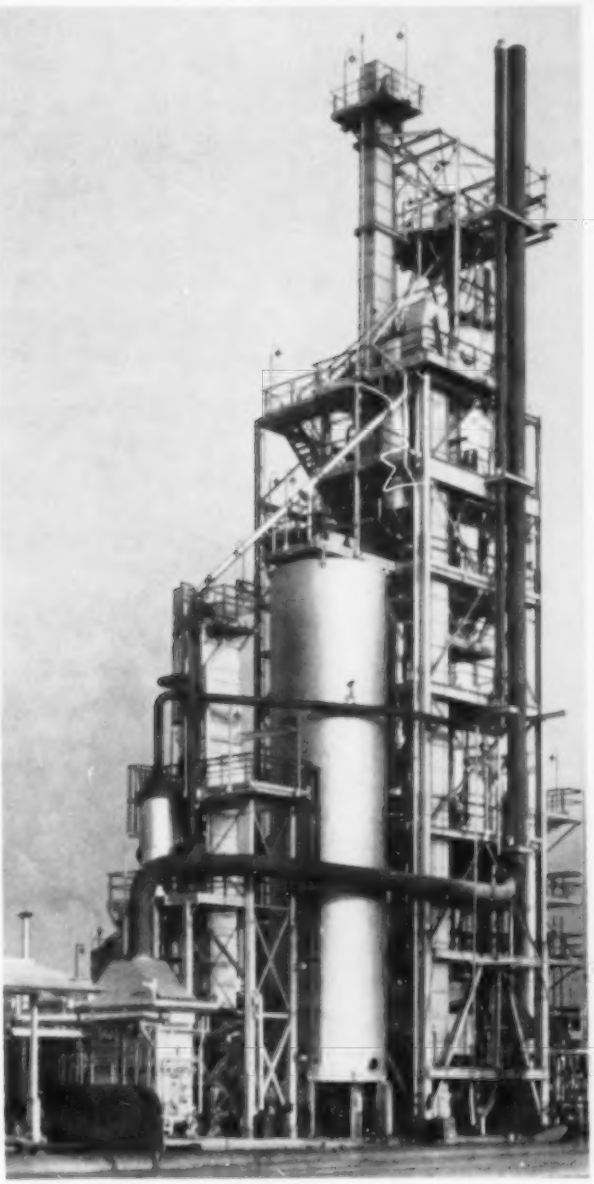
(3) Myers, H. C. and R. M. Owens, "Economic Survey of Thermofor Installations in Socony Mobil Lubricating Oil Refineries," *Oil and Gas Journal*, 44, 1393 (1945).

(4) Pukkila, A. O. and G. L. Payne, "How the First TCP Unit Operates," *Petroleum Refiner*, Sept. 1955, pp. 206-12.

(5) Pukkila, A. O., H. W. Shea, J. W. Batholomew and R. B. Killingsworth, "Continuous Percolation of Lubricating Oils," *Proceedings 4th World Petroleum Congress*, Rome.

(6) Simpson, T. P., E. S. Nicholls and J. W. Payne, "Recent Advancements and Applications of the Thermofor Kiln in the Petroleum Industry," *Transactions of the A.I.Ch.E.*, 34 (4) 841 (1940).





FIRST THERMOFOR CONTINUOUS PERCOLATION UNIT to be put into commercial operation is shown above at Coryton refinery of Mobil Oil Co., Ltd., English affiliate of Socony Mobil Oil Co., Inc.

Lube Oil Improvement

By Thermofor Continuous Percolation

UNFOLD FOR START OF PROCESS DESCRIPTION

You a target?

Let's face it . . . we're all targets!

If your plant is not ready with a disaster plan, better act now. There's not a single American plant that's out of range of an intercontinental bomber—and fires, floods, tornadoes or explosions can kill you just as dead as an atom bomb.

It costs next to nothing to take a few simple steps which may save hundreds of lives. Here they are. Check them off today.

☐ **Call your local** Civil Defense Director. He'll help you set up a plan for your offices and plant—a plan that's safer, because it's integrated with community Civil Defense action.

☐ **Check contents** and locations of first-aid kits. Be sure they're adequate and up to date. Here, again, your CD Director can help. He'll advise you on supplies needed for injuries due to blast, radiation, etc.

☐ **Encourage personnel** to attend Red Cross First-Aid Training Courses. They may save your life.

☐ **Encourage your staff** and your community to have their homes prepared. Run ads in your plant paper, in local newspapers, over TV and radio, on bulletin boards. Your CD Director can show you ads that you can sponsor locally. Set the standard of preparedness in your plant city. There's no better way of building prestige and good community relations—and no greater way of helping America.

Act now . . . check off these four simple points . . . lives are at stake . . . have you a right to delay?

Monel Bubble Cups and Tray for top of new fractionating tower completely engineered and fabricated by Fritz W. Glitsch and Sons, Inc., Dallas, Texas. Notice Monel weirs and baffles.

Here's where Monel proves year-after-year resistance to common tower-top corrosives

Tower-top corrosion *can* be held within practical limits.

Monel* nickel-copper alloy bubble caps proved *that* long ago. Their record . . . at temperatures up to 500 F. . . shows outstanding resistance to the aqueous hydrochloric and sulphuric acids and the corrosive salts commonly present in this critical upper section.

Today, for towers handling corrosive streams, Monel alloy is preferred in this location.

The men with the sharp pencils say Monel alloy costs less per pound than other commercially available alloys able to withstand the corrosion in tower tops.

Fabricators such as Fritz W. Glitsch & Sons, Inc., find it is easy to form . . . lends itself well to lined or clad construction. Increasingly, they find it specified not only for caps and trays but also for distribution pipes, fittings, linings, the shell itself and overhead condensers.

Another advantage. Monel equipment can be field erected and easily field repaired. No heat treatment after welding is required to maintain corrosion resistance.

How is your tower down-time record? If it's not what it should be and corrosion is the cause, look into the possibilities of Monel alloy construction. Simply write Inco's Corrosion Engineering Section. *Registered trademark

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO **Nickel Alloys Perform Better Longer**

11 ALL-IMPORTANT FACTORS WHICH DETERMINE THE VALUE AND EFFICIENCY OF PROCESSING FURNACES

✔**UNIFORM HEAT DISTRIBUTION**
MAXIMUM FUEL EFFICIENCY
PLENUM CHAMBERS FOR HAZARDOUS AREAS
SIMPLICITY OF DESIGN AND CONSTRUCTION
EXCESS DRAFT FOR HIGH OVERLOAD
EXPLOSION RESISTANT
MINIMUM GROUND SPACE
SHORT LENGTH OF LIQUID TRAVEL
ZERO AIR LEAKAGE
LOW PRESSURE DROP
LOW MAINTENANCE

✔**UNIFORM HEAT DISTRIBUTION** the most desirable heater characteristic is created in an Iso-Flow furnace by:

1. Individual burners are so spaced in relationship to the heating elements that they create a symmetrical flame pattern with relation to the tubes;

2. The metal cone at the top of the combustion chamber re-radiates to the tubes, also diverts combustion gases progressively closer to the tubes to give a uniform heat intensity at the upper portion of the combustion chamber;

3. The combustion gases, at the top of the heater, are diverted towards the walls where they recirculate from the top of the heater downward, behind and between the tubes, increasing the heat input to the rear of the heating elements by convection;

4. The recirculated gases reduce the heat intensity at the bottom of the furnace so that the heat input is the same, top and bottom.

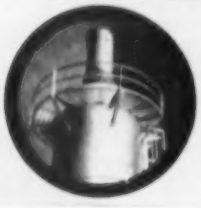
These factors provide the completely uniform heat distribution required in heaters for the most efficient process operation.

In every case where these 11 all-important design characteristics were employed to compare one type of furnace design with another, PETROCHEM-ISOFLOW FURNACES *were proved most efficient by any comparison.*

Prove PETROCHEM-ISOFLOW FURNACES Most Efficient by Any Comparison

More than 1200 PETROCHEM-ISOFLOW FURNACES *are in operation throughout the world in the petroleum, chemical and allied industries . . . for all processes and for any duty, pressure, temperature and efficiency . . . and all Petrochem-Isoflow Furnaces are pre-eminently satisfactory.*

PETROCHEM-ISOFLOW FURNACES



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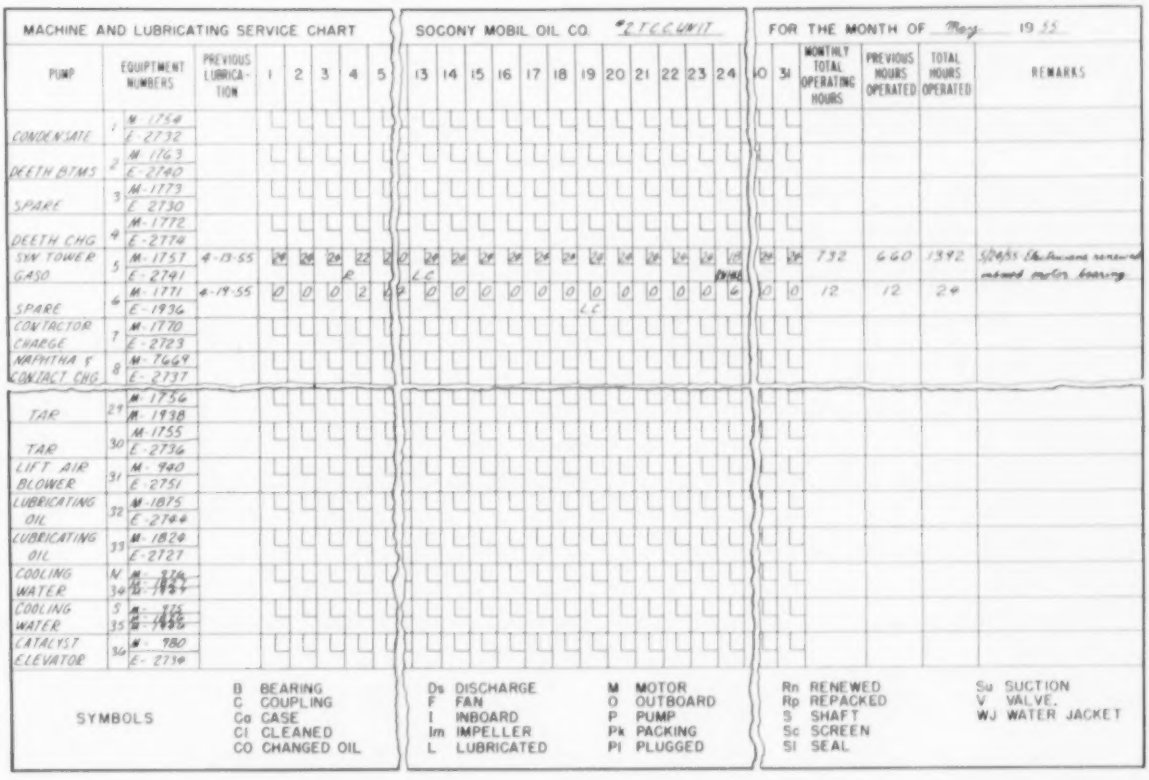

MACHINE AND LUBRICATING SERVICE CHART — SOCONY MOBIL OIL CO. "2 TCC UNIT — FOR THE MONTH OF May 19 55

PUMP		EQUIPMENT NUMBERS	PREVIOUS LUBRICATION	1	2	3	4	5	13	14	15	16	17	18	19	20	21	22	23	24	30	31	MONTHLY TOTAL OPERATING HOURS	PREVIOUS HOURS OPERATED	TOTAL HOURS OPERATED	REMARKS
CONDENSATE	1	M-1754																								
		E-2732																								
DEETH BTMS	2	M-1763																								
		E-2740																								
SPARE	3	M-1773																								
		E-2730																								
DEETH CHG	4	M-1772																								
		E-2774																								
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SPARE	6	M-1771	4-19-55	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	12	24	
		E-1936													LC											
CONTACTOR CHARGE	7	M-1770																								
		E-2723																								
NAPHTHA & CONTACT CHG	8	M-7669																								
		E-2737																								
TAR	29	M-1756																								
		M-1938																								
TAR	30	M-1755																								
		E-2736																								
LIFT AIR BLOWER	31	M-940																								
		E-2751																								
LUBRICATING OIL	32	M-1875																								
		E-2744																								
LUBRICATING OIL	33	M-1824																								
		E-2727																								
COOLING WATER	N	M-776																								
	34	M-1937																								
COOLING WATER	S	M-776																								
	35	M-1935																								
CATALYST ELEVATOR	36	M-980																								
		E-2739																								

SYMBOLS

B BEARING
C COUPLING
Ca CASE
Cl CLEANED
CO CHANGED OIL
Ds DISCHARGE
F FAN
I INBOARD
Im IMPELLER
L LUBRICATED
M MOTOR
O OUTBOARD
P PUMP
Pk PACKING
Pl PLUGGED
Rn RENEWED
Rp REPACKED
S SHAFT
Sc SCREEN
Sl SEAL
Su SUCTION
V VALVE,
WJ WATER JACKET

Here's a Chart That Reduces Unit Upsets

USUALLY, new records are regarded as a "pain in the neck" by shift operators, but here is a record form that's paying off at Socony Mobil's East St. Louis refinery.

This "monthly machine maintenance and lubricating service chart" for the new Thermofor Catalytic Cracking unit was adopted in May, 1955. It's already paying off in reducing unit upsets caused by switching to spare equipment for lubricating purposes. The form also provides an accurate current record of maintenance costs, and permits efficient forecasting for preventative maintenance and lubrication.

The chart has proved of special value to the shift operator because it lets him know exactly how long each piece of equipment has been operating. Knowing this, he is alerted to which item should be watched.

The mechanics of keeping the new service chart work like this: At 7 a.m. each morning, the unit stillman on the Thermofor Catalytic Cracking unit checks the operating log for entries on equipment changes, lubrication, or parts renewed during the past 24 hours. He records this on the sheet, using the proper symbols from the legend at the bottom of the chart.

Then, at the end of the month the chart is circulated to the managers of the lubricating, electrical and mechanical departments. The information presented allows them to keep accurate (and similar) records of equipment performance. This aids each in scheduling next month's work, as well as provides a running record on maintenance costs for each piece of equipment. The advantages to the operating department is a lower number of equipment switchovers—and better operating performance.

Previously, all equipment was lubricated on a rigid schedule that took no account of recent service, lubrication or repairs. In several instances of starting up spare equipment to replace its operating counterpart, the operation of the entire unit was considerably upset.

It was also felt that over- or under-lubricated equipment might be contributing to the difficulties in getting the exact flow, pressure or temperature that had been maintained by the previously operating equipment.

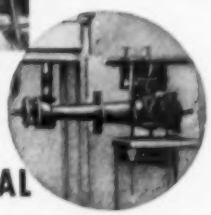
To reduce unit upsets, and prevent over-lubrication and unnecessary work for both operating and maintenance people, the new chart was used. Results to date justify its adoption.

This short article is based on an award-winning suggestion submitted by E. C. Jennings, Kansas City, Mo., refinery, Phillips Petroleum Co.

How Would You Pour An Open Joint?

SOMETIMES, a new concrete wall or structure has to be poured next to an existing one. Frequently,

VERTICAL



OR

HORIZONTAL

many more hours on stream without forced shutdown with NATIONAL AIROIL

OIL-GAS TANDEM COMBUSTION UNITS

Exclusively for vertical firing, the new National Airoil VERTICAL Tandem Block Units retain all the features of our regular horizontal Tandem Units . . . *plus:* special, pre-cast refractory shapes for easier, cost-saving vertical installation and maintenance; secondary air inlet louvres for positive control of vertical flame pattern; and, all steel duplex detaching gear which enables swift, simple vertical burner changeover.

VERTICAL and HORIZONTAL Tandem Units hold air in the combustion zone until fuel and heated air are thoroughly mixed. This means that ignition takes place in a hot zone; the result: high fuel economy through more rapid combustion with a minimum of excess air. NATIONAL AIROIL's patented Tandem Combustion Units allow secondary air to be easily and accurately controlled. By adjusting air control louvres, flame can be shaped to radiate heat uniformly without tube impingement.

The VERTICAL or HORIZONTAL Tandem Unit is always fired with NATIONAL AIROIL Combination Oil and Gas Burners . . . has a high turndown ratio with a steady flame temperature using either fuel oil or gas. With the TANDEM UNIT'S clean flame, a cold furnace can be brought to full capacity in a short time.

"Many, many more hours on stream, without shutdown" . . . yes, YOU will realize higher profits from YOUR heaters when NATIONAL AIROIL VERTICAL or HORIZONTAL Tandem Units are specified. Our new Bulletin 498 is yours for the asking.

CHEMICAL-PETROLEUM DIVISION

NATIONAL AIROIL BURNER CO., INC.

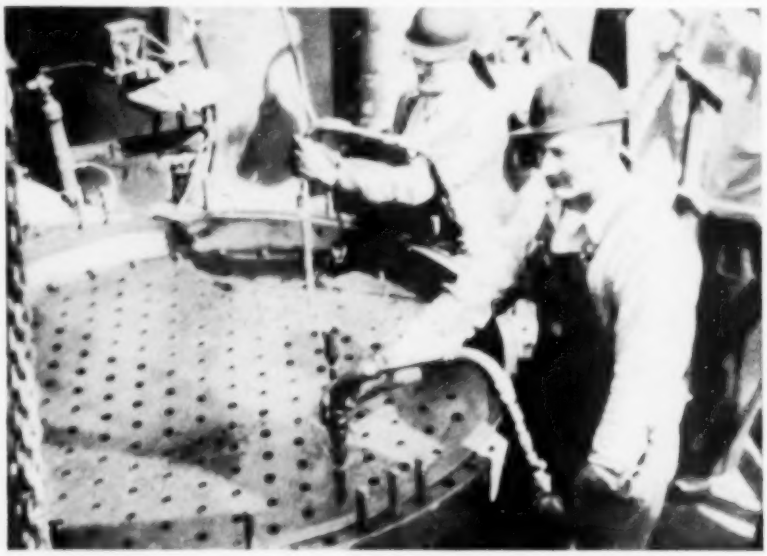
1297 EAST SEDGLEY AVE., PHILA. 34, PA.
Southwestern Division
2512 South Boulevard, Houston 6, Texas
INDUSTRIAL OIL BURNERS, GAS BURNERS, AND FURNACE EQUIPMENT

the joint between the two structures must allow for considerable expansion—from ½-in. to 1-in. Or, for some other reason, as with foundations that must be isolated from other structures, a small space is specified between the old and new concrete.

When the joint is specified to be left open, the question arises—how to form the adjoining face of the new wall and then strip the form?

Construction engineers at one large refinery solved this problem by impaling foam glass block of the proper thickness on the existing wall, which acted as the form for the face of the new wall. Foam glass was selected because it would not absorb water from the wet concrete, and it could be easily pulverized after the pour and washed out with hoses.

Result was a 1-in. space between two large surfaces and a clean, open joint.



In-Place Cleaning Cuts Down-Time

ORDINARILY, it's difficult to remove accumulated oil from Stratco Contactor tubes in an alkylation plant without disassembling the unit. But the engineering department at Shell Oil Co.'s refinery at Wood River, Ill., has developed a method of cleaning these tubes in place. They've found that the method saves appreciable maintenance time, thereby decreasing the down-time for the unit.

By using the new in-place cleaning system, two contactors were recently cleaned with a down-time of only three shifts per reactor. Previous down-time was a minimum of 18 shifts for each contactor.

Briefly described, the refrigeration system of Shell's alkylation unit includes four Stratco Contactors with bayonet tube bundles. There is no provision made for draining the lubricating oil that was carried over from the ammonia compressor and accumulated in the bottom of the fin tube bundles. Unless the oil was drained from the vertical contactor, the refrigeration capacity would be reduced.

Past practice was to remove both the bayonet and fin tube bundles. The bundles were then lowered to the ground and water washed and dried. This required a minimum of 18 shifts per contactor.

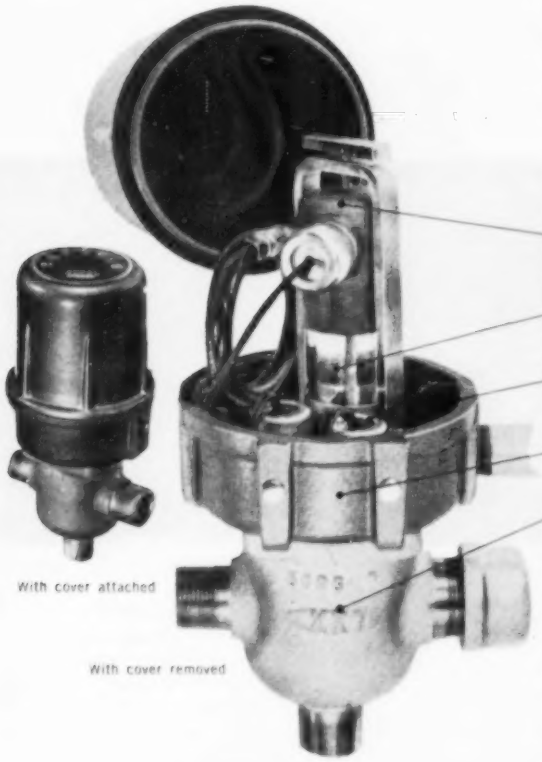
The new method of in-place cleaning is as follows: Approximately 800 gal of alkylate bottoms are flushed through the bundle to wash out the tubes. This removes some of the accumulated oil and solids. The oil remaining in the system after this wash is diluted with the wash solvent. Next, the top head is removed and each bayonet tube "pressured" with nitrogen to open the tube, if plugged.

Then, each tube is evacuated through a ⅜-in. diameter pipe lance reaching to the bottom of the tube and connected to a vacuum tank truck. A sight-glass in the suction hose indicates when the tube is empty. For this use, the vacuum tank truck uses a steam eductor instead of a vacuum pump because of the presence of volatile hydrocarbons.

 (To obtain more data on advertised products see page 178)

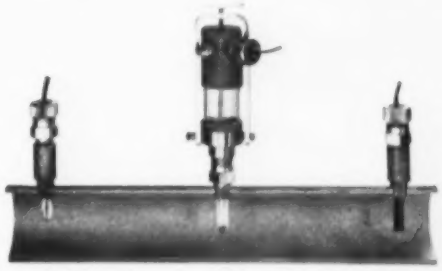
pH UNDER PRESSURE

The Beckman pH Flow Assembly is equipped with a *pressurized electrode* which allows you to get accurate pH measurements in process streams under pressure. A small pressure differential is maintained on the specially-developed reference electrode to prevent the process solution from contaminating the electrode and to keep the KCl liquid in the electrode flowing freely at the correct rate. Beckman Flow Assemblies are in use where solutions are moved about under pressure (chemical, petroleum), where sterilization is necessary (food, pharmaceutical), in large tanks and vessels where hydrostatic head or a variable liquid level is a problem. To learn how pH control may be applied to your process, mail the coupon today. Beckman Instruments, Inc., Process Instruments Department, Fullerton, Calif.

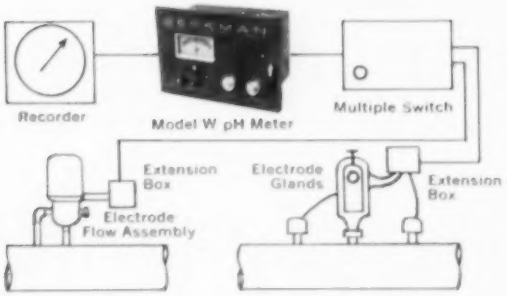


The Beckman Flow Assembly consists of these 5 elements:

1. **PRESSURIZED REFERENCE ELECTRODE** operates efficiently in pressures up to 100 psi. The electrode's large reservoir holds plenty of KCl and amount of liquid can be visibly checked at all times.
2. **BECKMAN GLASS ELECTRODE** is dependable, accurate and virtually unbreakable.
3. **THERMO-COMPENSATOR** is a resistance element that makes a true pH reading possible regardless of temperature changes (range from 32° to 212° F).
4. **CAST ALUMINUM BODY** prevents damage to electrodes. The leak-proof cover protects the unit from moisture and permits installations indoors or out.
5. **STAINLESS STEEL FLOW CHAMBER** resists corrosion from elements in the process stream.



THE GLAND ASSEMBLIES consist of the same elements (electrodes and thermo-compensator) and may be installed in a main process line with pressures up to 100 psi.



TYPICAL PRESSURIZED HOOK-UP. The *Flow Assembly* is installed into a sample or by-pass line, the *Gland Assemblies* directly into the main process line when a by-pass line is not practical. The *Multiple Switch* provides a means of monitoring up to six separate electrode assemblies with a single *Model W pH Meter*. A *Recorder-Controller* will automatically control the process to keep streams at a constant pH factor.

Beckman / *process instruments*
BECKMAN INSTRUMENTS, INC. FULLERTON, CALIF.

☐ Please send me a pH System Analysis Form that will entitle me to a free engineering analysis and recommendation for solving pH problems at our plant.

☐ Please send me a copy of "Industrial pH Measurement and Control" and add my name to your mailing list to receive additional information on pH control.

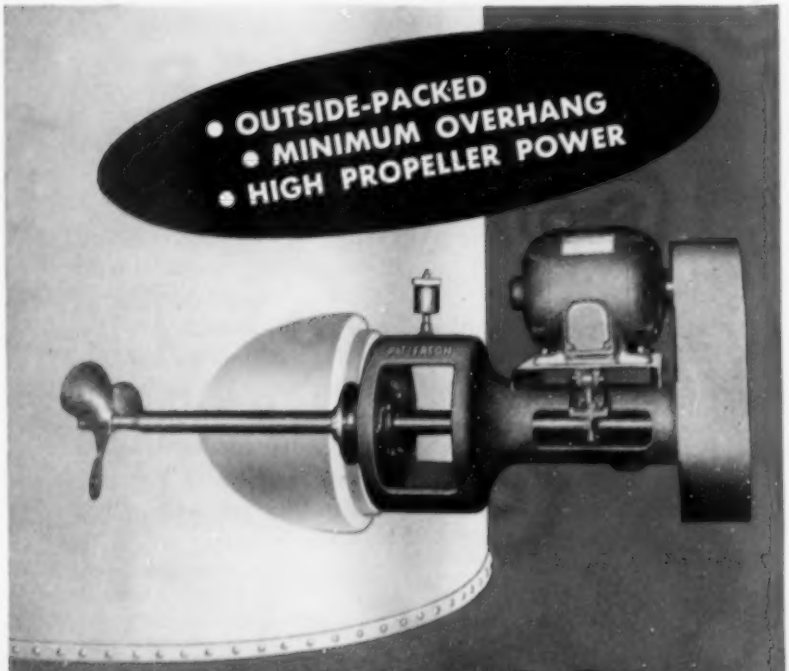
Name: _____ *Title:* _____

Firm: _____

Street: _____

City: _____ *Zone* _____ *State* _____

(To obtain more data on advertised products see page 178)



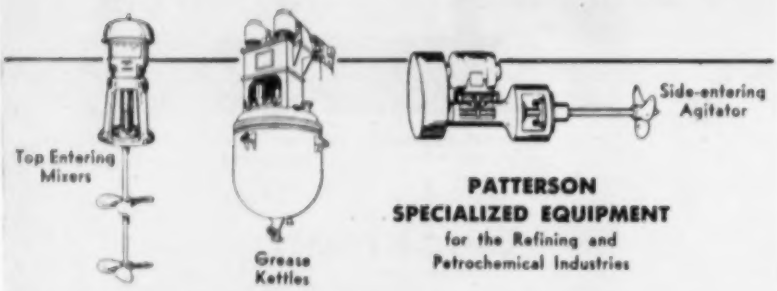
PATTERSON

SIDE-ENTERING AGITATORS

V-BELT • GEARED • GEAR MOTOR

Compact, simple and sturdy Patterson Side-Entering Agitators meet the highest standards for continuously dependable performance. Outside packing is replaceable with tank full. Short overall length. Get the facts —send for latest Bulletin!

Richard L. Cameron
President



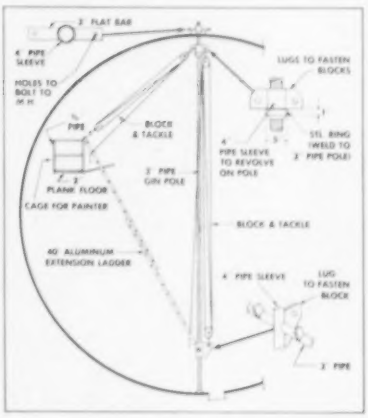
PATTERSON SPECIALIZED EQUIPMENT
for the Refining and Petrochemical Industries

The Patterson Foundry and Machine Company
East Liverpool, Ohio, U. S. A.
NEW YORK, BOSTON, BALTIMORE, PHILADELPHIA, PITTSBURGH, DETROIT, CINCINNATI, ATLANTA, CHICAGO, ST. LOUIS, HOUSTON, DENVER, LOS ANGELES, SAN FRANCISCO, SEATTLE

The Patterson Foundry and Machine Company, (Canada) Limited
Toronto, Canada
MONTREAL

After a short interval, the tubes are again "vacuumed" to remove any rundown that has collected at the bottom of the tubes. The container is then reassembled and returned to service.

The average heat exchange improvement, using in-place cleaning, is not as great as that which results from the former disassembly method. This is due to the residual oil film and some solids which are left on the tube walls. However, the savings in maintenance cost and decreased downtime more than compensate for this type of cleaning.



Scaffold Reaches Any Spot In Spherical Tank

PROBABLY one of the most awkward scaffolding jobs in a refinery is that required for sandblasting or painting the inside of a spherical tank. A conventional tubular scaffold requires a lot of manhours for initial construction, plus extra time for shifting the boards about as work progresses. This type of scaffold also requires a lot of spot painting where it has touched the tank.

Phillips Petroleum Co.'s Kansas City refinery has developed an ingenious portable scaffold that cuts both erection and dismantling time. And during its use inside the tank it increases the efficiency of operation. A six-foot strip can be sand-blasted or painted completely around the tank; the scaffold can then be raised or lowered for another complete circuit in a matter of five minutes.

As shown in the above sketch, the portable scaffold touches the tank in only two places, both of which can be touched up easily after the scaffold is removed from inside the spherical tank. The same scaffold arrangement is also usable on blimp-type tanks.

(To obtain more data on advertised products see page 178)

a First!

3400° Unbelievably Strong CASTABLE REFRACTORY

PURO-TAB

HIGH-PURITY SUPER-ALUMINA CASTABLE CALCIUM-ALUMINATE BONDED, NO ACID

PURO-TAB is an extremely high-purity, low-iron, super-alumina Castable. It has, as its base, a tabular alumina aggregate bonded with a high-purity calcium-aluminate binder. Without question, it excels any other volume-stable Refractory Castable on the market today.

for CATALYTIC CRACKING and REFORMING UNITS

PURO-TAB
is designed for use in the OIL REFINING, CHEMICAL and METALLURGICAL INDUSTRIES

- OUTSTANDING STRENGTH
- VOLUME STABLE
- HIGH PURITY

MIX WITH WATER

PURO-TAB needs only to be mixed with water and can be placed by pouring or extruding; like any other castable refractory product.

PURO-TAB
has the following characteristics:

- High in Alumina (93.6%)
- Hydraulic Setting
- Resists Erosion
- Outstanding Strengths
  Bulk Density (Lbs./Cu. Ft.—160.9)
  Modulus of Rupture (Lbs./Sq. In.—1934)
  Cold Compressive Strength (Lbs./Sq. In.—10,010)
- Maximum Service Temperature of 3400° F.
- High Resistance to Abrasion
- Volume Stable
- Not Affected by Reducing Atmospheres or Carbon Deposition
- Low Iron Composition (well under 1% by weight)
- Especially Adapted to Atmospheres of High Sulphur Fuels and Charge Stocks

PURO-TAB has "NO EQUAL"

Reports from leading research men in the consuming industries state that "There is no refractory castable equal to PURO-TAB in meeting the conditions for which it has been designed."

The physical and chemical characteristics of PURO-TAB qualify it for the following types of applications:

- Cyclone Separators, Reactors, Regenerators and Lines in Catalytic-Cracking and Reforming Units of Refineries.
- and . . . for similar applications requiring high P.C.E., high purity and extra high strengths (both modulus and cold crushing).

MEX-R-CO

Write — Phone — or Wire

MEXICO REFRACTORIES COMPANY

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Divisions: NILES FIRE BRICK CO., Niles, Ohio • NATIONAL REFRACTORIES CO., Philadelphia, Pa.
Canadian Affiliate: REFRACTORIES ENGINEERING & SUPPLIES, LTD., Hamilton, Ontario, Canada

13

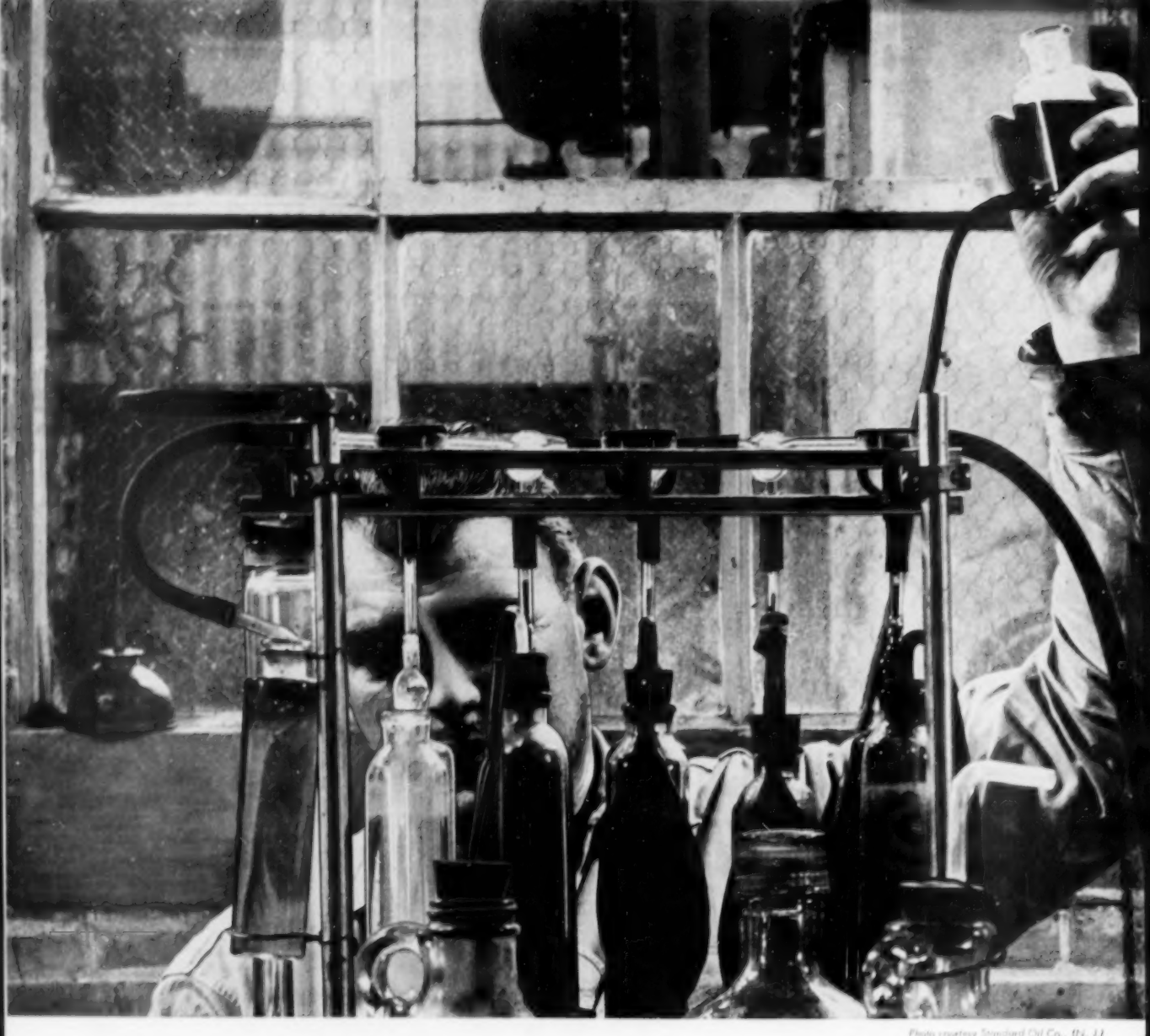

Photo courtesy Standard Oil Co., Ind.

boost average ratings as much as 2 octane numbers *with the LJUNGSTROM® AIR PREHEATER*

With waste heat recovered and returned to the furnace in combustion air, the most modern heat-transfer systems can be operated at peak efficiency.

That's why you boost product quality with the Ljungstrom Air Preheater. Its heat-recovery efficiency makes possible advanced furnace designs that assure remarkably close control of processing. And finer control means a more uniform product . . . with average ratings as much as 2 octane numbers higher. One still's added income just from higher product quality is $58,000 annually.

How fast is "WRITE-OFF"?

In earnings from higher octane ratings, many refiners write off the cost of the Ljungstrom installation in less than two years. This time is cut to nine months and even less, when the other Ljungstrom advantages are taken into account – saves up to 20% in fuel costs . . . permits more economical furnace design, with no need for convection surfaces . . . burns many fuels you used to throw away . . . results in consistently higher through-put . . . and minimizes slag.

For more complete details on what the Ljungstrom Air Preheater can do for you . . . for an analysis of the heat recovery benefits obtainable in fuel burning equipment – call or write The Air Preheater Corporation.

Wherever You Burn Fuel, You Need Ljungstrom

The Ljundstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves, the heat is transferred from the waste gases to the incoming cold air.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

Do You Know These Words?

By B. H. WEIL
Manager, Information Services
Ethyl Corp., Res. & Engrg. Dept.
Detroit, Mich.

Acetophenone

Acetophenone, pronounced **"ass-es-toh-fee-known,"** is a petrochemical that has long been known as a useful material, but that only in the last six years has begun to find volume sales because of lowered price. Almost colorless, of sweet but pungent odor and taste, and soluble in alcohol but not in water, this material has the formula C_6H_5-CO-CH_3, which explains one of its chemical names—phenyl-methyl ketone (the phenyl group being C_6H_5-, the methyl group CH_3-, and the ketone group being -CO-). Slightly heavier than water per unit volume, acetophenone congeals at slightly below room temperature and boils at nearly 400°F.

Earlier uses of acetophenone included perfumes, hypnotics, and (as a solvent) cellulose resins. Newer uses include the synthesis of antihistamines, antispasmodics, vasoconstrictors, and other drugs, as well as corrosion inhibitors and dyes. On the horizon, if prices come down farther, are said to be synthetic resins, synthetic rubbers, and use as a solvent in vinyl coatings.

Acetophenone is manufactured from petrochemical intermediates in more than one way. The earlier method (still in use) employed benzene and acetic anhydride (the latter being an acetylene or ethylene derivative). The more recent commercial method is one used in the manufacture of styrene for plastics and GR-S synthetic rubber; acetophenone is the intermediate material produced in the synthesis of styrene by the catalytic oxidation of ethylbenzene (produced from benzene and ethylene). In all of these methods, therefore, the petroleum raw materials are catalytic reformates and cracked refinery gases or LPG.

Polypropylene

Polypropylene, new brother to now-fabulous polyethylene, is today only in the pilot-plant stage, but many confidently expect it some day to challenge polyethylene for use in at least fibers and films. A direct addition polymer of propylene molecules (CH_3-CH=CH_2, which adds up as -$CH(CH_3)$-CH_2-$CH(CH_3)$-CH_2-), polypropylene differs chemically from polyethylene in that every other carbon atom in its chains is attached to a methyl (-CH_3). Pronounced **"pahl**-ih-**pro**-pi-lean," the resin is quite similar to polyethylene in appearance and basic properties.

However, polypropylene is thought to have certain advantages over polyethylene in that its melting point is considerably higher—up to 300°F or more, which is said to be nearly 50°F higher than even the newer polyethylenes. This is a real selling point for use in fibers and films.

Another advantage is said to be the lower cost of its petroleum raw material, propylene. If the latter is produced as a (inevitable) by-product in the cracking of propane to ethylene, it costs only 1-2 cents lb, compared to about 5 cents lb for ethylene. The cost of propylene may be somewhat higher, however, if yields are maximized.

Copolymers of propylene and ethylene are said to be under study, as well as polymers of higher olefins than propylene (i.e., olefins with more carbon atoms in their molecular chains). Commercial development of polypropylene is expected on a large scale in the very near future, as soon as stabilizers are found to prevent oxidation and yellowing. The low cost of its raw material, propylene, and its high melting point (as compared with polyethylene) render it close to a petrochemical certainty.

NEWS in VIEWS

GIANT CRANE saves valuable construction time at Richfield Oil's Watson, Calif., refinery by swinging a 109 ton hydrogenation reactor into place without use of rigging setup. Boom length of 87 ft permits crane to place 36 ft long pressure vessel on 30 ft high concrete piers shown in background

EVEN THIS IS TOO MUCH!

How much does critical leakage cost your company—not just in accidents but in expensive downtime, repairs, and loss of production?

You ***can*** have ***no leakage*** sealing of flanges, fasteners, or fittings, even under extremely adverse conditions of temperature, pressures and corrosive action.

Why not find out about the "O-Seal family."* There are many standard parts as well as specials to solve almost any static sealing problem. We'll gladly furnish full particulars upon request.

*Lock O-Seal • Stat O-Seal • Gask O-Seal
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FRANKLIN C. WOLFE CO.

"sealing design specialist"

Culver City, California

Vapor Pressure

WHAT IS IT: Vapor pressure is the force (expressed in psi) exerted by molecules attempting to escape from a body of liquid.

As liquids physically change into a gas, their molecules travel with greater energy and create what is called "vapor pressure." It is the one and only pressure (at a specified temperature) at which a pure liquid can exist in equilibrium with its own vapor.

If, in a closed system, the pressure is increased above the vapor pressure, the gas will condense and only liquid will remain. If the pressure is reduced below the vapor pressure the remaining liquid will become a gas. A liquid and its vapor will always reach equilibrium in a closed system. The equilibrium pressure does not change, even though the amounts of either liquid or vapor may change, and is a function only of temperature and nature of the liquid.

VAPOR AND GASES: All gases behave according to certain temperature-pressure relationships. The most common one is expressed as

$$PV/T = \text{a constant}$$

where P = absolute pressure, V = volume, and T = absolute temperature.

A common characteristic of gases is their ability to condense into liquids when pressure is applied or heat is removed, or some combination of the two. However, there is one critical point above which a gas will not liquefy due to a pressure increase alone. This point is called the **critical temperature.**

When a pure gas is below its critical temperature, the gas is then called a **vapor.** Another way of saying this is that all vapors will condense into liquids but all gases will not.

The pressure that is required to compress and condense a vapor at this critical temperature is called the **critical pressure.** The accompanying table gives examples of some of these critical constants.

Critical Gas Constants

Gas	Critical Temperature °F	Critical Pressure psi abs
Acetylene	97	911
Air	−221	544
Benzene	551	701
Butane	306	550
Carbon dioxide	88	1,073
Ethane	89	715
Ethyl alcohol	470	926
Ethylene	49	745
Helium	−459	29
Heptane	512	397
Hexane	454	440
Hydrogen	−400	191
Methane	−116	673
Nitrogen	−233	500
Oxygen	−182	735
Octane	564	362
Pentane	386	485
Propane	205	616
Sulfur dioxide	315	1,161
Water (steam)	705	3,205

VAPOR PRESSURE OF SOLIDS: Usually vapor pressure is associated only with liquids, but solids have vapor pressures too. However, there are relatively few materials which sublime at room conditions, i.e., change directly from a solid to a gas without passing through the normal liquid phase. Common examples of these solids which have appreciable vapor pressures are iodine, arsenic, camphor and CO_2 (dry ice). The common example of clothes drying outdoors in below freezing temperatures is further proof that some materials vaporize without passing through a liquid phase.

REID VAPOR PRESSURE: A special vapor pressure is used in the petroleum industry to rate the volatility of gasolines. This is the vapor pressure under specified conditions, at a temperature of 100° F. Called the Rvp (Reid vapor pressure), values are expressed in psi gage and are determined by an empirical method prescribed by ASTM standards.

NGAA VAPOR PRESSURE: Another special measurement of vapor pressures is that sponsored by the Natural Gasoline Association of America. This method measures the vapor pressure of liquified petroleum gases, under fixed volume and temperature conditions. It is very similar to the empirical method for measuring the "LPG Vapor Pressure" adopted by ASTM in 1953. Results of both of these empirical methods of rating vapor pressures are expressed in psi gage at 100° F.

(It is wise to remember that these empirical methods of determining Reid vapor pressure, or LPG Vapor Pressure, do not give the true vapor pressure, due to limitations of the testing procedure. True vapor pressure may be 5 to 9 per cent greater than the Reid vapor pressure.)

VAPOR PRESSURE AND BOILING POINT: An increase in temperature at the surface of a liquid increases the vapor pressure, as well as the rate at which liquid changes to vapor. If enough heat is added to the liquid to raise the vapor pressure to the external pressure of the system, then the liquid will boil. Thus, the normal boiling point is the corresponding temperature for a specific vapor pressure—the point at which the vapor pressure equals 760 mm of Hg.

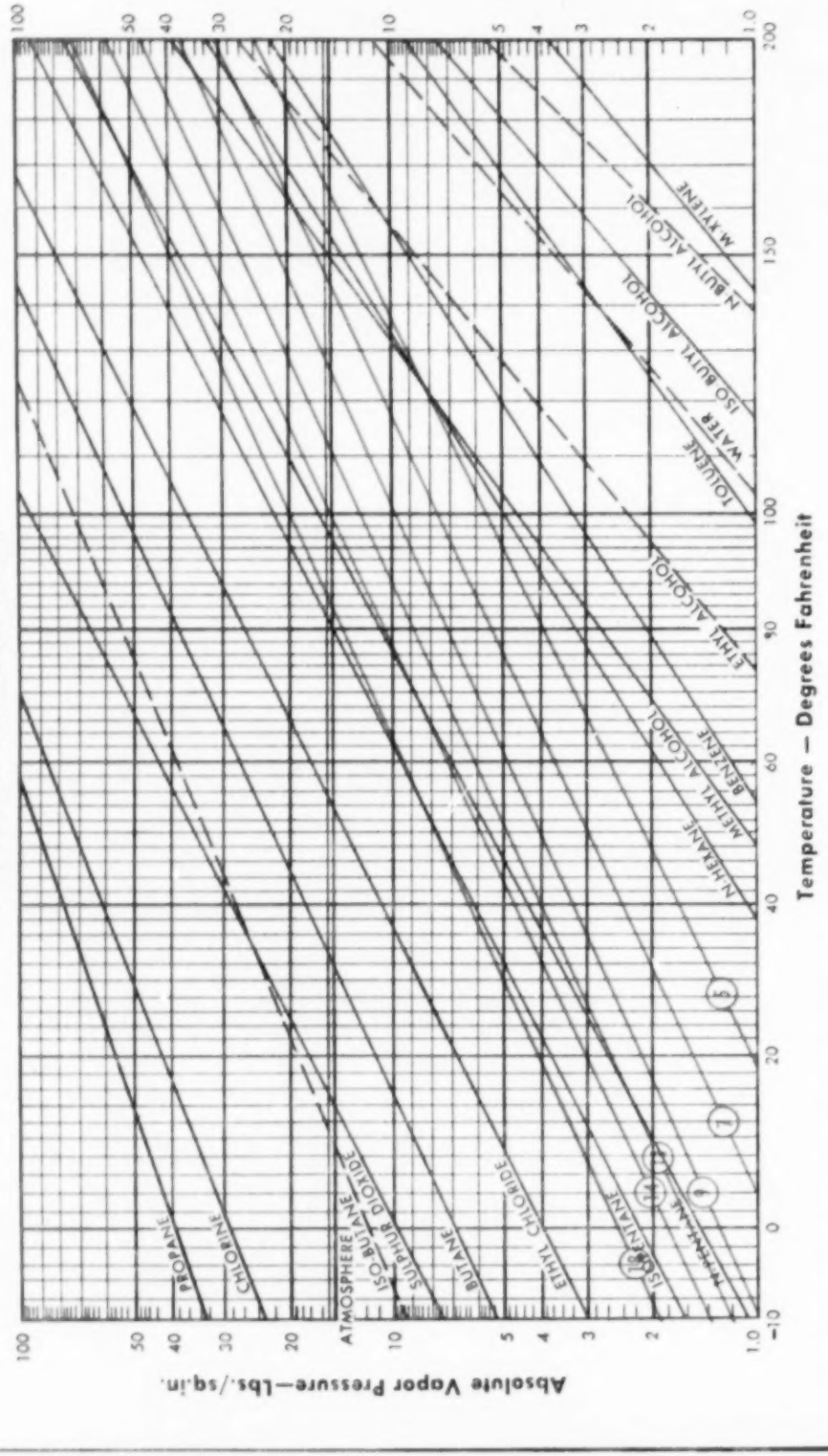
VAPOR PRESSURE OF MIXTURES: Vapor pressure created by one pure liquid will not affect the vapor pressure of a second pure liquid, when both are mixed within the same system. The total vapor pressure for insoluble and nonreacting mixtures is the sum of the vapor pressures of the individual components.

However, for reacting materials and solutions, such as alcohol and water, the total vapor pressure is appreciably less than the sum total of the individual vapor pressures.

For petroleum, which is a mixture of many compounds, vapor is extremely important. It defines many of the refining processes used for crude, as well as the operating characteristics of most of the refined products.

For More Data, Turn the Page . . .

VAPOR PRESSURES



Red lines indicate true vapor pressures of gasolines. Circled numbers identify grades according to vapor pressures as obtained by the Reid method.

Mr. Ely

Mr. Davis

Mr. Levin

API Certificates Go to Four Refiners

APPRECIATION for services to the oil industry was given by the American Petroleum Institute with the presentation of certificates to four men in the refining industry. Awards were made during the mid-year meeting of the Refining Division at Montreal. Honored were Allen J. Ely, Esso Research & Engineering Co.; Harry Levin, The Texas Co.; J. B. Rather, Sr., retired, Socony Mobil Oil Co.; and C. E. Davis, retired, Shell Oil Co. Because of illness, Mr. Rather could not attend the meeting, and his award was received by his son, J. B. Rather, Jr., who is not shown.

Above photographs by courtesy of the Ethyl Corp.

Herbert S. Chase, vice-president of manufacturing for Tidewater Oil Co.'s eastern division, has retired after 34 years of service.

Mr. Chase

Chase joined the company in 1922 as a development engineer at the Bayonne, N.J., refinery. Five years later he became assistant general foreman of the plant, and in 1928 he was made assistant superintendent of the process department. In 1930 he was advanced to chief engineer, and in 1933 became the refinery's superintendent.

In 1943, Chase was transferred to New York as divisional manager of manufacturing. Shortly afterward he was elected vice-president of manufacturing and in 1945 became a director.

Harold G. Mangelsdorf, formerly a member of Esso Standard Oil Co.'s executive committee and a company director, has been made chairman of the advisory committee on human relations of Standard Oil Co. (N.J.).

Mangelsdorf is the committee's first full-time chairman. The committee was established in 1948 to make studies in fields related to human relations and to advise the Jersey board of directors of the findings. The appointment underlines the increasing importance placed on this type of information by the company.

Edward A. O'Neal, Jr., has been elected president of the Chemstrand Corp., succeeding **Henry H. Bitler,** who has resigned and is returning to the American Viscose Corp.

O'Neal has left Chemstrand's parent organization, Monsanto Chemical Co., where he was vice-president for international operations and a director.

Harry N. Stevens has been appointed director-research operating of the B. F. Goodrich Co. He has been research coordinator in the company's Brecksville, Ohio, research center.

Staff changes at the research center are as follows:

Jerard Sindelar has been assigned to the chemical engineering research and development department as a technical man. He has been at the center since 1946.

Samuel J. Caprette, Jr., has joined the center's staff as a technical man in the technical service research group.

Miss Jane Ferguson has been assigned to the staff as a technical man.

James R. Miller has been appointed research chemist. He joined the company as a chemist 13 years ago.

E. Ray Hooser has joined the company as an analytical chemist.

Glenn E. Wilson has been named director of employe relations for Goodrich-Gulf Chemicals. He began with B. F. Goodrich in Akron in 1928 as an accountant. He has held a number of responsibilities at plants in Akron and Louisville. In 1951 he was named director of employe relations for B. F. Goodrich Chemical Co.

Nicholas J. Campbell, Jr., has succeeded **Lloyd G. Smith** as vice-president and director of the Creole Petroleum Corp. Smith has retired after 43 years in the oil industry. Campbell has been in the legal department of Creole since 1947.

Smith began with Standard Oil Co. (N.J.) in 1932. He was with Lago Oil & Transport Co. from 1933 until 1944. In 1947 he joined Creole as a vice-president of refining with offices in New York. He was made a director in 1947.

Horace O. Kippels has been appointed a senior engineer in the Mobay Chemical Co. design engineering department. Kippel has been with Monsanto Chemical Co. since 1950 and joined the Mobay subsidiary last March 16.

L. A. Woodward has been elected administrative vice-president of Kerr-McGee Oil Industries, Inc. Woodward was formerly president of Mid-West Refineries, Inc., of Grand Rapids, Mich.

Allen R. Kittleson has been given the title of senior research associate with Esso Research & Engineering Co. Only three other employes now hold this title in the company. Kittleson, a chemist, is the inventor of an important fungicide and, before the second World War, did research in petrochemical processes and lubricant additives.

William E. Lifson, William T. Knox, and **Richard O. Wright** have been appointed assistant division directors in the company. Lifson has been assigned to the products research division, Knox to process research, and Wright to the economics division.

Stanley Tutwiler has taken Lifson's former post of head of the additives research section in the products research division. He was a group head in the industrial lubricants section.

Knox was previously head of the product quality section in process research, and Wright was supervising engineer of the refinery economics section in the economics division.

J. R. Stein, assistant general manager of Dow Chemical Co.'s Texas

In water conditioning... there's one way to be sure!

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Division, has been appointed project manager of the company's new Louisiana Division. Under the direction of Dr. A. P. Beutel, Stein will take active charge of constructing and developing the new division. Stein has been with the Texas Division since 1940 and was made assistant general manager three years later.

B. G. Caldwell has been assigned to organic chemical production, and **K. C. DeFoe** will join the executive staff of the new division. **D. G. Griffin** goes to production control and economic evaluation, **P. G. Ferrarese** to public relations, and **J. C. Harvey** to industrial relations in the Louisiana Division.

J. M. Parish has been transferred to engineering, construction and maintenance, in the division.

Howard C. Anderson, Continental Oil Co., has succeeded **George E. Hinckley** as chairman of the Rocky Mountain Oil & Gas Association's refining division.

Elected vice-chairman: **Harrison Brewer,** public relations manager for Husky Oil Co. These men were elected counselors to the division; Hinckley, who is industrial relations manager for Utah Oil Refining Co.; **A. F. Ryan,** Ethyl Corp.; **L. Cochran,** Du Pont Co.; and **Ben H. Loper,** American Cyanamid Co.

P. H. Bohart has been made vice-president of planning and economics for Gulf Oil Corp. He was formerly vice-president of production. The appointment activates the planning and economics department.

W. J. Sweeney, vice-president of petroleum products and medical research for Esso Research & Engineering Co., has been named chairmen of the automotive research committee of the American Petroleum Institute.

R. W. Provine has been named director of the chemical research section of D-X Sunray Oil Co.'s West Tulsa research laboratories. **C. Prather** has become director of the quality control section, and **V. L. Brant** director of the chemical engineering section. **J. V. Lawson** has been appointed director of the technical sales service section. D-X Sunray is the refining and marketing subsidiary of Sunray Mid-Continent Oil Co.

W. O. Hoffman has been appointed superintendent of the mechanical department of Atlantic Refining Co.'s Philadelphia refinery. He succeeds J. P. McCulley, who is retiring in August after 47 years with the company. **J. W. Braun,** formerly assistant to the manufacturing vice-president, has been made superintendent of the chemicals department. **A. J. Ferkel** has been appointed assistant superintendent.

A. A. Muse has become technical assistant to the manufacturing vice-president, and **W. E. Chalfant** assistant manager of the product control department. **K. G. Krech** has been appointed assistant general manager of crude oil purchases and sales department.

F. O. Koontz has been appointed to the new position of executive vice-president of Quaker State Oil Refining Corp. Koontz was previously a director and vice-president of the company.

Three other directors were elected vice-president: **Dr. C. W. Georgi,** director of research; **J. P. Healy,** manager of oil properties and pipe line; and **E. E. Ebner,** general superintendent of refineries.

Mr. Love

Mr. Clulow

M. P. L. Love has succeeded **F. S. Clulow** as manufacturing vice-president of Shell Oil Co. Clulow has retired after 36 years with Shell.

Love began with the company in 1935 and held posts at Wood River, New York, and the Houston research laboratory before he became manager of the manufacturing research department in 1948. From 1951 to 1954 he was manager of the Houston refinery. Since that time he has been on a special assignment.

Clulow was named department manager at the Martinez, Calif., refinery in 1930, 10 years after joining the company. In 1934 he became manager of the East Chicago refinery and in 1938 returned to the West Coast to become manufacturing vice-president of Shell refineries.

Minor L. Fahrmann has been appointed assistant chief engineer of California Oil Co.'s refining division. Fahrmann supervised construction of

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(To obtain more data on advertised products see page 178)

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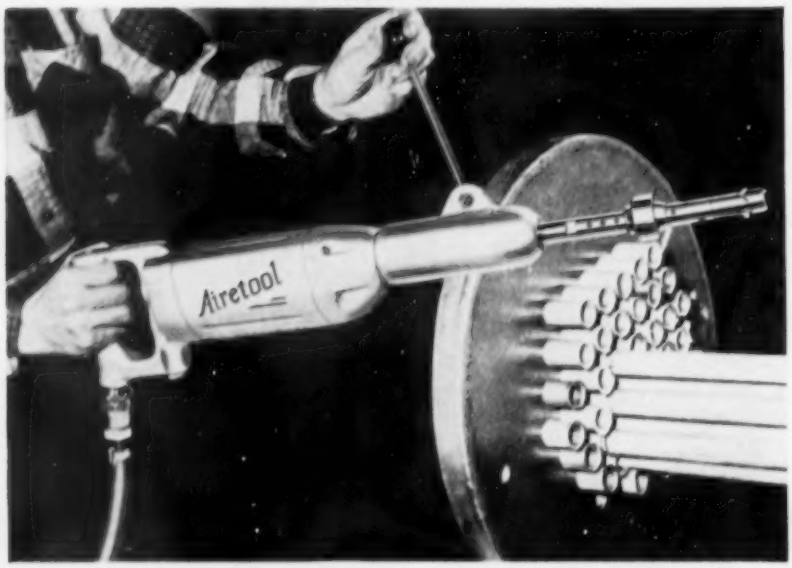

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AIRETOOL'S new, lightweight, portable tube cutter removes damaged or leaky heat exchanger and condenser tubes faster and more economically than ever before. Self-centering, double-action, hardened steel tool bits cut nonferrous and steel tubes ⅝" to 1" in diameter, through tube sheets 1" to 4" thick. Operator governs rate of cut through positive feed control, eliminating gouging or burning and increasing life of tool bits. The new single-stage air-driven motor, designed and precision built by AIRETOOL, is powerful and easy to use. Available in speeds of 200, 265, 335 and 625 r.p.m.

AIRETOOL'S new tube cutter is also available with electric driven motor for use where air supply is not available, and in a push-type design which can be adapted for use with your own electric or air motors. AIRETOOL Internal Tube Cutters are an economical necessity, invaluable for tube maintenance programs.

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the company's new cracking and reforming facilities at Perth Amboy in 1951 and was one of the American engineers who helped reactivate the Abadan refinery in Iran in 1954.

K. E. Beall, vice-president of Phillips Petroleum Co.'s economics department, has been assigned to the newly created post of vice-president and petroleum consultant, reporting to the executive staff. **C. E. Turner** has been promoted to manager of the economics department. Turner was manager of the department's reservoir division.

Leroy Culbertson has been named assistant manager of the natural gasoline department. He succeeds **Roy M. Teel,** who recently resigned.

Louis P. Sumpter has become director of the company's engineering and construction division, and **H. R. Marckley** succeeds him as director of the operating division.

Robert E. Lenz has been appointed assistant director of the chemical research department, research and engineering division, of Monsanto Chemical Co. Lenz has been special project manager for the division. His new post will be at Dayton, Ohio, where he will direct the engineering research section of the department.

Charles L. Lightfoot, Jr., has been made manager of new product development in the division's development department. He was formerly assistant manager of goverment contacts in the department.

J. Kenneth Craver has joined the chemical research department of the division in Dayton. He will head a special applications research program. He has been with General Mills, Inc., for the past two years, but previously was with Monsanto's organic chemicals division.

Robert J. Simon has become a project engineer for the development department of the overseas division. **Frank I. Jones** has shifted from the Organic chemicals division's Cincinnati office to New York. **August R. Hempel** has moved from St. Louis to Cincinnati.

Obituary

Dr. August A. Schaerer, 52, died May 15 at this home in Orinda, Calif. He was employed by Shell Development Co. at the Emeryville research laboratories and was known as an authority on petroleum waxes. He joined Shell in 1928 and had most of his service with the company in Southeast Asia. He is survived by his wife.

(To obtain more data on advertised products see page 178)

AIEE Petroleum Conference, Sept. 17-19

TWO sessions for the refining industry will be offered at the third Electrical Conference of the Petroleum Industry, sponsored by the American Institute of Electrical Engineers. Meeting will be at the Muehlebach Hotel in Kansas City, Mo., September 17-19.

Papers to be heard in the refining sessions are as follows:

"Factors in Indoor and Outdoor Switchgear Applications," by J. Dunki-Jacobs and D. S. Brereton, General Electric Co.

"Application of Aluminum in Metal Enclosed Switchgear and Bus Duct," by C. L. Carlson and R. H. Rutter, Westinghouse Electric Corp.

"Adequate Design and Proper Application of Insulated Aluminum Wire and Cable," by H. R. Stoddard, R. E. Gross, G. A. Snow, Simplex Wire & Cable Co.

"Advantage of Silicone Rubber Insulation for large Motors and Generators," by J. E. Kuehlthau, Allis-Chalmers Mfg. Co.

"Adequate and Economical Electrical Design and Application in Refineries," by E. C. Benjamin, M. W. Kellogg Co.

"A Stability and Voltage Study to Determine the Performance of an Oil Refinery Distribution System," by D. Dalasta, Allis-Chalmers Mfg. Co.

"Non-Explosion Proof Motors in Refining Areas," by E. Talley, Esso Standard Oil Co.

"New High Interrupting Capacity Molded Case Circuit Breaker," by W. H. Edmunds, I-T-E Circuit Breaker Co.

Top Catalysis Scientists To Appear at Congress

Eighty-one papers from scientists throughout the world will be read at the International Congress on Catalysis, September 10-14 at the Bellevue-Stratford Hotel in Philadelphia. Some outstanding workers in the field of catalysis are expected to present papers: R. L. Burwell, Jr., M. Calvin, J. H. deBoer, D. A. Dowden, A. G. Oblad, G. M. Schwab, H. H. Uhlig, and I. Wender will be among them. Also, Eugene J. Houdry, Sir Hugh Taylor and Sir Eric Rideal will address the congress at various times.

Here is a complete listing of the general topics to be covered:

Symposium on Chemistry and Physics of Solid Catalysts

1-Hydrogenation and hydrogen exchange reactions
2-Physical properties of catalysts
3-Electronic properties and catalytic activity

Symposium on Homogeneous Catalysis and Related Effects

1-Acid-base catalysis
2-Catalysis by metal compounds
3-Reaction kinetics

Symposium on Surface Chemistry and Its Relation to Catalysis

1-Corrosion and surface reactions
2-Chemisorption of oxygen
3-Adsorption phenomena

Symposium on Techniques and Technology of Catalysis

1-Catalytic cracking and cracking catalysts
2-Isomerization and other reactions of hydrocarbons
3-Reactions of carbon monoxide
4-Tracer and other techniques
5-Miscellaneous catalytic reactions

West Coast Meeting To Be ASTM's 'Biggest'

The largest technical program to be presented at a meeting of the American Society for Testing Materials will be offered at the second Pacific area national meeting, from September 16 to 22 in Los Angeles.

Seventeen symposiums and nine special sessions on research and testing of materials are planned. Among the symposiums will be these:

Railroad materials—diesel fuel and lubricants, cleaning materials
Lubricants analysis (spectrographic analysis of lubricating oils)
Turbine oils
Industrial water
Nondestructive testing
Radioactive isotopes

API Sets Sights on 1957 Mid-Year Meeting

With the smoke cleared from the 1956 mid-year meeting of the American Petroleum Institute's Refining Division, the Program Committee is already at work on next year's event. The dates are May 13-16; the place, Philadelphia in the Penn-Sheraton Hotel.

Refiners are promised eight sessions and the usual banquet. One session will be held on each of these topics: Anti-Knock Quality (sponsors: Petroleum Products and Automotive Research Committees), Corrosion, Electrical Equipment, Instrumentation, Smoke and Fumes, Training, and Processes. Two sessions are planned on Analytical Research.

Oil Man's Calendar

JULY

Recent Advances in Catalytic Polymerization, course at MIT, Cambridge, Mass., July 17-27.

Silver Bay Conference on Human Relations in Industry, sponsored by the YMCA, July 18-21.

AUGUST

6th International Symposium on Combustion, Combustion Institute, Yale University, New Haven, Aug. 19-24.

Disposal of Industrial Wastes by Biochemical Processes, course at MIT, Cambridge, Mass., Aug. 20-31.

SEPTEMBER

International Congress on Catalysis, Bellevue-Stratford, Philadelphia, Sept. 10-14.

Pacific Coast Gas Assn., annual, Coronado, Calif., Sept. 11-13.

National Petroleum Assn., annual, Traymore Hotel, Atlantic City, Sept. 12-14.

Chemical Institute of Canada, Western Regional Conference, Edmonton, Alta. Sept. 13-15.

American Society for Testing Materials, Pacific area national meeting, Statler Hotel, Los Angeles, Sept. 16-22.

American Chemical Society, annual, Atlantic City, Sept. 16-21.

Electrical Conference of the Petroleum Industry, American Institute of Electrical Engineers, Kansas City, Mo., Sept. 17-19.

Instrument Society of America, annual Instrument-Automation Conference and Exhibit, Coliseum, New York, Sept. 17-21.

Western Petroleum Refiners Assn., regional technical-industrial relations meeting, Hotel Henning, Casper, Wyo., Sept. 20-21.

Petroleum Mechanical Engineering Conference, American Society of Mechanical Engineers, Statler-Hilton Hotel, Dallas, Sept. 24-26.

Independent Oil Compounders Assn., annual, Bismarck Hotel, Chicago, Sept. 24-25.

Natural Gasoline Assn. of America, regional, Oklahoma City, Okla., Sept. 28.

OCTOBER

American Institute of Electrical Engineers, fall general meeting, Morrison Hotel, Chicago, Oct. 1-5.

National Assn. of Corrosion Engineers, south central region, Beaumont, Tex., Oct. 2-4.

Lubrication Conference, jointly sponsored by ASLE and ASME, Chalfonte-Haddon Hall, Atlantic City, Oct. 8-10.

Oil Progress Week, Oct. 14-20.

American Gas Assn. annual, Atlantic City, Oct. 16-17.

Natural Gasoline Assn. of America, regional, Shreveport, La., Oct. 26.

National Lubricating Grease Institute, annual, Edgewater Beach, Chicago, Oct 29-31.

ADDITIVES	GULF COAST		MID-CONTINENT		WEST COAST	
	$ Saving	% Saving	$ Saving	% Saving	$ Saving	% Saving
Du Pont Antioxidant No. 22	$2,250	6.7%	$2,250	6.7%	$2,400	7.0%
Du Pont Fuel Oil Additive No. 2	$1,680	8.3%	$1,710	8.4%	$1,850	8.9%
Du Pont Lube Oil Additives	$1,830	12.0%	$1,860	12.0%	$2,000	12.5%

Shown above are nine typical situations—three locations, three additives. They illustrate how substantial sums can be saved when you order Du Pont additives in 4,000-gallon tank-car lots. The saving is over the costs of the same quantities in less than carload lots, in drums. The total savings shown reflect lower product cost and lower freight rates.

Four-figure savings are yours each time you order a Du Pont additive by the tank car

If you have been buying your additives in drums—either in carload or less than carload quantities—it will pay you to investigate the savings in delivered cost that are possible by ordering in tank-car lots.

For example . . .

The above chart shows how refiners in three areas can save from $1,680 to $2,400 simply by ordering a Du Pont additive by the 4,000-gallon tank car instead of equal quantities in partial car shipments in drums. These figures are, of course, based on the freight rates for only three locations; savings will vary somewhat for other receiving points. However, the saving will be decidedly worthwhile anywhere . . . for any one or more of the products listed.

How much can you save?

To answer that question for you, one of our nearby representatives will be glad to call at your refinery, study your freight rates and inventory patterns. He will then determine the most convenient handling method for you and figure the exact saving you can make. Phone, write, or wire us . . . today.

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(To obtain more data on advertised products see page 178)

By Peter J. Gaylor, Patent Attorney, Elizabeth, N. J.

How to Produce Boron Additives From a Liquid Paraffin Fraction

RAISING motor fuel octane number with a boron compound additve has been discussed by workers of Standard Oil Co. (Ohio).[1] These additives are claimed to counteract, in part, the effect of sulfur compounds on tetraethyl lead and, by reducing deposits in hotter areas, to lengthen exhaust valve life.

An unusual method for producing low-cost organo-boron compositions for lubricants and fuels is disclosed in U.S. Patents No. 2,721,121 and 2,721,181, issued to Kendall Refining Co.

The patents relate how novel organo-boron compositions can be produced by passing a free oxygen-containing gas through a normally liquid paraffinic petroleum fraction having a boiling point from 350 to 800°F. Temperature is maintained within 305-385°F. In the fraction there are from one to three chemical equivalents, per mole of paraffinic hydrocarbon, of an acid from the group consisting of ortho-boric and meta-boric acid. The gas is passed through the fraction so that not more than about 0.6 cu ft of oxygen is produced per hr/gal of the fraction. This results in a crude reaction product with at least 0.2 wt-% chemically combined boron.

So that compositions are produced that don't form too much solid material by sedimentation or hydrolysis it is important not to exceed the three chemical equivalents of acid per mole of paraffinic hydrocarbon present during the oxidation reaction.

Also, the relative concentration of acid in the reaction mixture should not fall below about one chemical equivalent per mole. Otherwise, a crude reaction mixture will form with insufficient chemically combined boron to make a good lubricant or fuel additive. The reaction mixture must have at least 0.2 wt-% chemically combined boron.

The quantity of ortho- or meta-boric acid available for reaction at any time during the process varies with the quantity of water present in the reaction mixture, and thus depends on the oxygen supply to the mixture.

To maintain an adequate acid concentration in the reaction mixture, oxygen must be fed in at a rate not much above 0.6 cu ft/hr/gal of the paraffinic fraction. If more is supplied, water is removed from the reaction mixture and the acid concentration changes. Then the product shows excessive sedimentation and hydrolysis when blended with lubricating compositions, such as hydrocarbon oils and synthetic lubricants, and with fuels.

The starting materials must be chosen not only for their yield, but also after considering whether they produce a composition that won't unduly increase the pour point of the liquids to which they may be added. Generally, liquid mineral, oil-soluble paraffins that boil between 350 and 800°F may be employed. Solid, wax-type materials yield solid products, less desirable as lubricant or fuel additives.

It's best if the starting materials boil within 500 and 600°F. If separation of the organo-boron materials is desired, the boiling range should not exceed about 100°F.

Essentially pure paraffins have proved to give the greatest yield of desired products. Therefore, it is advantageous to remove any aromatics from the charge stock. Naphthenes and olefins also should be removed before starting the process. Recovered, unoxidized charge stock from previous runs may be utilized as a starting material either as is or after a light earth or acid treatment. An ideal charging stock has a molecular weight high enough so that the crude reaction mixture will give a good yield of borates and have such volatility characteristics that no distillation will be necessary before using it as a lubricant. Such a crude product would be characterized by a viscosity in the light oil range and would not need excessive concentration.

The most satisfactory charge stocks make reaction mixtures that may be employed as lubricant or fuel additives, without treatment. In most instances, however, "crude" organo-boron compositions useful as lubricant or fuel additives are obtained by simple distillation of the reaction mixtures to remove the lower boiling components. In general, distillation at a pressure from 0.3 mm to about 100 mm mercury and temperature from 200 to about 425°F is adequate for this purpose. Such "crude" organo-boron compositions normally boil at a temperature above the boiling range of the charge stock, and hence unreacted charge stock may be removed by distillation.

The hydrolytic stability of the organo-boron compositions may be improved by incorporation of organic carbinol compounds (i.e. compounds derived from methanol, CH_3OH) and, particularly, high molecular weight aliphatic alcohols, polyalkylene glycols, etc.

The organo-boron compositions of both the "crude" and "purified" type are claimed to have particular value as additives to improve the oxidation characteristics of lubricating oils. Of special significance is the fact that organo-boron compositions themselves demonstrate lubricating properties and so can be used in large proportions—up to about 100%—in lubricant blends. They are best blended in a concentration of about 5 to 30 wt-% with conventional lubricants, such as hydrocarbon oils, or synthetic lubricants, such as poly-propylene glycols and polyesters.

Suprisingly, it has been found that organo-boron compositions are more effective as anti-oxidants when incorporated in lubricants containing a substantial proportion of aromatics than when blended with lubricants that are more highly refined, and therefore, largely free of aromatics. Refining techniques in the industry in recent years have been directed toward removal of aromatics. Deposit-forming tendencies of mineral oils are directly related to the degree of refinement; for example, unextracted bright stock forms about 2½ times as much deposit as does 1100 grade aviation oil, in steel strip tests.

This relationship is reversed in the presence of the organo-boron compositions. The less highly refined mineral oil stocks containing the compositions of the patent form much less deposit in comparative steel strip tests than more highly refined, aromatics-free oils with the same proportion of organo-boron compositions. Furthermore, the less highly refined oils containing the organo-boron products demonstrate markedly less increase in viscosity than the others when the oil blends are exposed to oxidation.

The organo-boron compositions are also said to have marked utility as

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accounts for the remarkable performance of DeZurik Valves. The eccentric-shaped, resilient-faced plug swings shut without friction . . . . closes on the eccentric-raised seat, sealing tight despite scale, dirt or other solids in the line.

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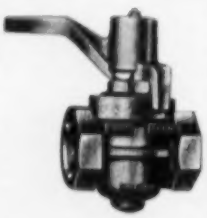

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SHOWER COMPANY
SARTELL, MINNESOTA

additives for internal combustion engine fuels, such as gasoline and diesel fuels. They can be employed in such fuels in concentrations up to about 5%.

It is claimed that fuels containing the compositions show less tendency to form deposits in combustion chambers and less pre-ignition, particularly in high compression engines.

(1) Technical Survey, 1956, p. 299.

Add Polymer to Lube Oils For Sludge-Resistance

U. S. PATENT NO. 2,737,496, issued to the Du Pont Co., discloses dispersive lubricating oil compositions having superior resistance to sludge formation and varnish deposition in internal combustion engines.

To the lubricating oil is added at least 0.1 wt-% of an addition-type polymer that is oil-soluble and basic amino nitrogen-containing. Most of the polymer is composed of polymerizable, ethylenically unsaturated compounds. At least one compound is amino-free and contains 8 to 18 carbon atoms in an aliphatic hydrocarbon chain. The chain is not part of the main polymer chain. The compound, as it exists in the polymer, contains a basic amino nitrogen in the side chain. The polymer has from 0.1 to 3.5 wt-% basic amino nitrogen.

The following is an example of the preparation of such a copolymer additive: 47.5 parts of n-octyl methacrylate, 2.5 parts of betadiethylaminoethyl methacrylate, and 0.25 part of alpha, alpha'-azodiisobutyronitrile were heated together in a polymerization reactor under an atmosphere of oxygen-free nitrogen at 58 ± 3°C. for 18 hours. A stream of nitrogen bubbling through the polymerization mixture did the stirring. There was obtained an oil-soluble, tacky, resinous copolymer of the two polymerizable components in essentially the proportions charged, i.e., 95/5.

Two-Stage Sweetening with Solutizer and Caustic

MERCAPTANS can be converted to disulfides by air-blowing in the presence of a solubility promoter, which need not be an oxidation catalyst. The mechanism appears to be as follows: mercaptans first go from the oil phase to the aqueous phase; there, both the mercaptan and total sulfur content of the oil are reduced. The mercaptans are oxidized in the aqueous phase, presumably to insoluble disulfides, which then return to the oil phase. This increases the sulfur content, which gradually returns to its original value while the mercaptan content drops to zero. The caustic solution is thus continuously regenerated, so that no separate regeneration process is required.

According to U.S. Patent No. 2,729,591 issued to British Petroleum Co., Ltd., considerable conversion of mercaptans to disulfides may be effected by means of an aqueous caustic alkali solution alone. It is therefore advantageous to treat the oil first with an aqueous alkali containing no solubility promoter in the presence of oxygen, then with the solutizer solution also in presence of oxygen. This procedure offers a more economical use of solutizer and also reduces the time of contact with the oil, considerably improving the color of the product.

The process is capable of sweetening a naphtha containing 0.05 wt-% mercaptan sulfur. Contact time required is about 20 to 30 min in a two-stage process when the naphtha is given a 50/50 wash with the solutizer solution. Commercial cresol may be used as the solubility promoter.

Distillates Sweetened With Isocyanates

PATENT No. 2,723,944 issued to Universal Oil Products Co. describes the sweetening of sour cracked gasoline with an isocyanate, polyisocyanate, or isothiocyanate. Examples are methyl or phenyl isocyanate, tolylene or butylene diisocyanate, propyl isothiocyanate, etc.

One additional advantage claimed for these compounds is that they will react with phenols, an excess of which is undesirable. The sweetening is effected in presence of an alkali metal hydroxide. Enough is claimed to be present after ordinary caustic washing, which is done as a preliminary treating operation. Atmospheric temperatures or temperatures up to 220°F. or more may be employed.

Examples given show 97% reduction in mercaptan content after 24 hours residence time.

Remove Gasoline Diolefins With Activated Carbon

APPARENTLY, gasoline containing diolefins, particularly in conjunction with mono-olefins and naphthenes, increases engine fouling. Work recently has been directed toward selective removal of the diolefins that

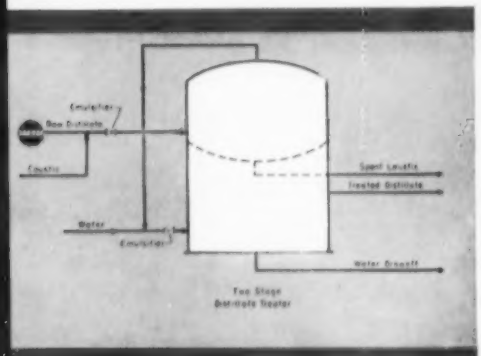
(To obtain more data on advertised products see page 178)

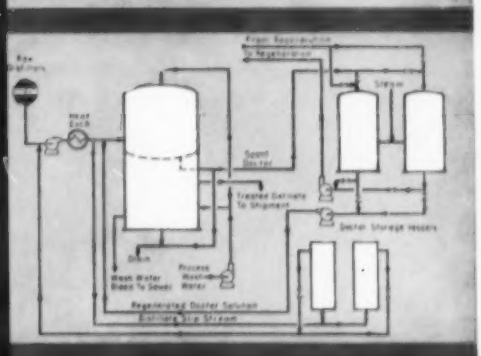
IF YOU CAUSTIC WASH, ACID TREAT, DOCTOR TREAT OR SWEETEN....

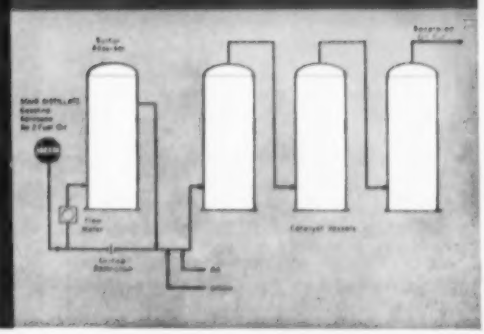
PETRECO

EQUIPMENT WILL HELP YOU DO IT BETTER

Petreco Electrofining permits the precision-controlled, continuous contacting of light hydrocarbons with a treating agent, then rapidly separates the chemical from the product. Electrofining delivers a finished product, from tower to market, with a brief treating period and negligible settling time.







PETRECO ELECTROFINING FOR DISTILLATE TREATING

Petreco Electrofining, as applied to caustic washing or acid treating, or combinations of these with water washing, has rendered conventional processing obsolescent. Compared with the large ground areas and multiple vessels of old-fashioned treating plants, Electrofining equipment does the job in a small space with one or two small vessels, less piping, fewer pumps, and, since it operates continuously and automatically, less operating attention.

ELECTROFINING — DOCTOR TREATING

In Petreco Electrofining-Doctor Treating, the doctor solution is continuously dispersed into the gasoline stream treated. The volume of doctor solution, degree of dispersion and contacting time are precisely controlled by automatic instrumentation. The powerful Petreco electric field coalesces the dispersed phase of mixture resulting from the doctor solution injection and separates the spent doctor solution from the gasoline. "Blackstrap" is removed continuously, resulting in more efficient spent doctor regeneration.

PETRECO-BENDER SWEETENING

The Bender Process sweetens gasoline, kerosine, jet fuel and No. 2 fuel. It is especially effective in the kerosine-No. 2 fuel range. Sweetening is effected by converting mercaptans to disulphide by oxidation. There is no product loss in Bender Processing and chemical costs are around .5 cents per barrel. To attain treatment, sulphur is added to the distillate, plus a small amount of alkali, plus air. This mixture is passed over a bed of solid catalyst, yielding a sweet, bright, non-corrosive product.

PETRECO *A DIVISION OF PETROLITE CORPORATION*

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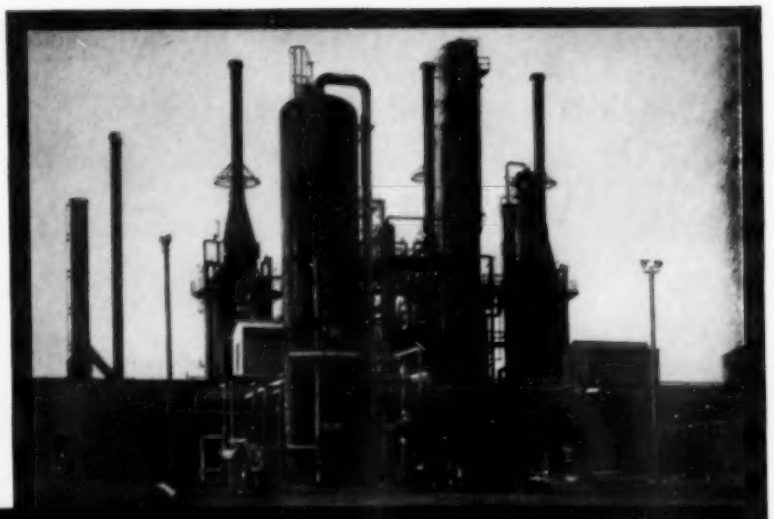
TO INSURE

smooth operations
more time on stream
lower operating costs
better products



TRETOLITE REFINERY SERVICES

DESALTING

CORROSION PREVENTIVES

FUEL EMULSION PREVENTIVE

METAL DEACTIVATOR

Desalting the crude charge before refining is now accepted as standard operating procedure. Desalting removes salts which evolve into corrosive acids. It prevents salt plugging of condensers, exchangers and towers, and keeps solids and fines from entering the refinery. Tretolite desalting is an automatic, all chemical process, consistently delivering salt removals in the 98 to 100% range.

Kontol Corrosion Preventives combat internal corrosion, hydrogen blistering, fouling and scaling. They are organic semi-polar liquids which protect by adsorbing at metal surfaces as a tough, impervious film. They are readily adsorbed from dilute hydrocarbon solutions to form this film. In addition to their corrosion preventive properties, the Kontols are powerful detergents which clean and de-foul refining equipment.

Tretolite Fuel Emulsion Preventive is an organic, oil-soluble agent designed to prevent the emulsification and sludging of burning oils and diesel fuels. Oils treated with Tretolite Fuel Emulsion Preventive have shown no sludge formation even after a three month settling test.

Kuplex Metal Deactivator effectively deactivates copper in hydrocarbons such as gasoline, kerosine, jet fuel, diesel oil, furnace oil and turbine oil. Its powerful chelating action prevents hydrocarbon deterioration caused by metal catalyzed oxidation.

For complete information, technical data and prices, ask your Tretolite refinery service engineer or write to –

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A DIVISION OF PETROLITE CORPORATION
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Chemicals and Services for the Petroleum Industry

DESALTING • DEMULSIFYING • CORROSION PREVENTING
SCALE INHIBITING • FUEL OIL ADDITIVES • WATER
DE-OILING • PARAFFIN REMOVING • PRODUCTION
STIMULATING • BACTERICIDES • METAL CONDITIONERS

appear to be the troublesome constituents. In U. S. Patent No. 2,721,832, Esso Research and Engineering Co. describes a process whereby the gasoline is contacted with an activated carbon at 450°-630°F., 0-200 psig. pressure, and a space velocity of 0.5 to 10 v/v/hr. Diolefins are removed without substantially raising the final boiling point of the gasoline. The carbon may contain 0.2-10% of a potassium compound that promotes regeneration after carbon fouling. The deposit is removed at 900°-1300°F. by steaming, or by air oxidation at 850°-1300°F. The carbon is a particle size of 80-200 mesh, unless fluidized operation is used, when the size is 10-150 microns.

The octane number of the stock treated with activated carbon at below 630°F. is substantially higher than that obtained by treatment at higher temperatures. At yet lower temperatures than 627°F., substantially higher octane number may be obtained approaching or exceeding the octane number of the feed stock. Reduction in sulfur content also is said to be effected.

Patents Issued Recently

The following classified listing gives the patent number, patentee, or assignee, and a brief description of patents of interest to the petroleum processing industry, as listed in the Official Gazette of the U. S. Patent Office for April 17, 24, Vol. 705, No. 3 and 4, and May 1, 8, 15, Vol. 706, No. 1, 2, and 3.

PROCESSES

Refining

2,742,103 (Universal Oil Products Co.) Means for separating a mixed gaseous feed stream.
2,742,346 (Jefferson Lake Sulphur Co.) Recovery of elemental sulfur from gases containing H_2S by oxidation.
2,742,347 (Standard Oil & Gas Co.) Production of sulfur from gaseous mixtures containing hydrogen sulfide by partial oxidation.
2,742,400 (Texaco Development Corp.) Method of refining oil with a selective solvent (azeotropic furfural mixture).
2,742,401 (Esso Research & Engineering Co.) Methyl-ethyl ketone dewaxing process.
2,742,402 (Socony Mobil Oil Co.) Solid caustic alkali and phenol reagent for removing mercaptans from hydrocarbons.
2,742,405 (Esso Research & Engineering Co.) Catalytic conversion of hydrocarbons containing catalyst contaminants (oil soluble metallo-organic compounds).
2,742,406 (Phillips Petroleum Co.) Method of compensating for uneven coke deposition in the catalyst bed in a hydrogenolysis process.
2,742,407 (Gulf Oil Corp.) Fractionation process and apparatus.
2,742,409 (Esso Research & Engineering Co.) Revivification of spent contact clay with N-dialiphatic formamide.
2,742,411 (Esso Research & Engineering Co.) Recovery of furfural in extractive distillation purification of cyclic hydrocarbons.
2,742,497 (Sun Oil Co.) Recovery of naphthenic acids from other petroleum constituents, using phosphorus oxyhalide, etc.
2,742,213 (Union Oil Co. of Calif.) Wax deoiling process, using ketone.
2,743, 241-5 (Petrolite Corp.) Process for breaking petroleum emulsions.
2,744,051 (Universal Oil Products Co.) Treatment of fuel oil with an alkyl pyrrole and removing sediment to give improved storage stability.
2,744,054 (Shell Development Co.) Sweetening process using oxygen, alkali and a peroxide.
2,744,055 (Universal Oil Products Co. and California Research Corp.) Sweetening of hydrocarbon distillates with a phenylene diamine, an alkyl phenolate and air.
2,744,394 (Badger Manufacturing Co.) Separation of methane from C_1-C_3 gaseous mixtures by fractionation.
2,744,853 (The Texas Co.) Removal of metal contaminants from petroleum by means of iodine.
2,744,854 (Universal Oil Products Co.) Oxidation of mercaptans in presence of metal chelate and phenylene diamine.
2,744,855 (Standard Oil Co.-Ind.) Desulfurization process using alkali followed by extraction with liquid sulfur dioxide and a promoter.
2,744,887 (Phillips Petroleum Co.) Decomposing urea adducts by counter-currently contacting the urea adduct with a hot gas, removing the urea fines and recycling the larger urea particles.

Conversions

2,742,343 (Sun Oil Co.) Circulation of granular solids through a process system.
2,742,403 (Esso Research & Engineering Co.) Cracking and coking of reduced crude with the use of inert and catalyst particles.
2,742,404 (Socony Mobil Oil Co.) Catalytic reforming without thermal cracking.
2,742,468 (Sun Oil Co.) Catalytic reaction process by use of sonic vibrations.
2,742,410 (Lummus Co.) Continuous coking process.
2,742,518 (Esso Research & Engineering Co.) Naphtha from fluid coking of residua, in fluidized systems.
2,742,519 (Phillips Petroleum Co.) Isomerization of paraffin hydrocarbons with molybdenum oxide-alumina catalyst.
2,743,214 (Socony Mobil Oil Co.) "K" factor control of reformate yield.
2,743,215 (M. W. Kellogg Co.) Naphtha reforming reactions catalyzed by platinum and palladium catalysts.
2,743,216 (Esso Research & Engineering Co.) Calcination of fluid coke, utilizing shot.
2,743,217 (Allied Chemical & Dye Corp.) Distillation process by carbonizing finely divided coal.
2,743,218 (Esso Research & Engineering Co.) Recovery of product vapors and sulfur from fluid coke.
2,743,223 (U. S. A.) Producing hydrogen and polymer from cyclohexane by bombarding with neutrons.
2,744,052 (Shell Development Co.) Hydrogenation of hydrocarbon oils, tungsten, molybdenum, and nickel containing catalysts therefor and their preparation.
2,744,053 (Union Oil Co.) Hydrocarbon conversion process, including preliminary nitrogen removal by adsorption.
2,744,056 (Gulf Research & Development Co.) Catalytic conversion process employing, as catalyst, a halloysite clay activated with magnesium oxide.
2,744,057 (Gulf Research & Development Co.) Catalytic conversion process with the use of a base-exchanged silica-alumina catalyst.
2,744,058 (Gulf Research & Development Co.) Fluidized fixed bed destructive hydrogenation catalytic process.
2,744,856 (Charles B. Wendell, Jr.) Production of dense coke by retarding froth formation during coking.

PRODUCTS

Catalysts

2,742,345 (Deutsche Goldund Silber-Scheideanstalt vormals Roessler) Process for the production of finely divided silicates of low density.
2,742,437 (Oxy-Catalyst, Inc.) Catalytic structure and composition.
2,742,515 (Sun Oil Co.) Dehydrogenation catalyst (bauxite, etc. with metal oxide).
2,744,861 (Charles L. Thomas) Regeneration of catalysts by passing DC through fouled liquid catalyst.

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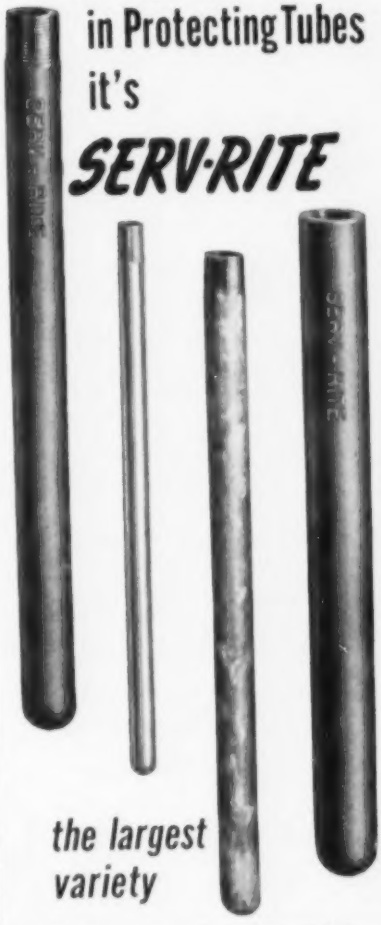

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(To obtain more data on advertised products see page 178)

Increase your process efficiency with accurate quality control

Increased process efficiency and precise quality control are only two of the many advantages that result from the application of continuous process refractometry to chemical process streams. This unique physical principle is a quick and simple method of determining whether a specific material, or mixture of materials, meets required specifications.

Product variations can be detected with great rapidity because a sample from the process stream itself is continuously flowing through the instrument and is compared with a reference standard. The process can be adjusted to maintain product characteristics within the desired tolerance, with a minimum of sub-standard throughput. These savings alone can quickly pay for the cost of an instrument.

APPLICATIONS—The Barnes Differential Refractometer has wide applications in the chemical, food, refinery and other process industries. Many processes in these industries have used continuous process refractometry for years to monitor product quality. For example, refractometry may be used to control:

Hydrogenation—of fats and oils in food and chemical streams;
Polymerization—of hydrocarbons, vinyls, styrenes, etc.;
Distillation—of petroleum or other fractions;
Blending—of binary mixtures.

OPERATION—The Barnes Refractometer measures an *unchanging* and *basic physical characteristic of a material:* refractive index. This gives a *true* measurement of stream composition—not a measurement of an environmental variable such as temperature, pressure, flow rate, etc.

The Barnes Refractometer provides a continuous indication of the difference in refractive index between the reference liquid and the continuously flowing sample from the process stream. Differences may be indicated on a scale at the front of the instrument, or they may be transmitted as electrical signals to a recorder controller.

SPECIFICATIONS—The Barnes Refractometer has an accuracy of better than ±½% and is available in three models with limiting sensitivities of refractive index covering 0.0001, 0.00001, 0.000002. The optical system is sealed against contamination; the entire instrument is explosion-proofed; the servo measuring system is of the null balance type for highest accuracy.

The Barnes Application Engineering Group is ready to assist you in evaluating the use of refractometry to your control problems. Special Data Sheets to help better service your problems are yours for the asking.

Complete description of the Barnes Refractometer and Data Sheets will be mailed upon request. Barnes Engineering Company, Stamford, Conn.

BARNES ENGINEERING COMPANY
CONTROL THROUGH ANALYSIS

Chemicals

2,742,445 (California Research Corp.) Styrene modified alkyd resins from 5-tertiary butyl isophthalic acid.
2,742,446 (M. W. Kellogg Co.) Admixtures of trifluorochloroethylene polymers and method for molding same.
2,742,467 (Phillips Petroleum Co.) Stabilization of polysulfone resins with a benzimidazolethiol.
2,742,454 (M. W. Kellogg Co.) Process for polymerizing CF_2-$CFCl$ in slurry system.
2,742,490 (Stanolind Oil and Gas Co.) Use of carbon monoxide for regeneration of acids from their formate salts.
2,742,492 (Ethyl Corp.) Stabilize nitrate formulations.
2,742,493 (Universal Oil Products Co.) Arylindan dicarboxylic acid testers.
2,742,498 (Gulf Oil Corp.) Amidic acids.
2,742,502 (The Texas Co.) Process for producing anilides.
2,742,505 (Phillips Petroleum Co.) Manufacture of ethylene glycol by partial oxidation of ethylene.
2,742,507 (Sun Oil Co.) Separation of methyl cyclopentane with alkyl chloride $AlCl_3$.
2,742,510 (M. W. Kellogg Co.) Process for dehalogenation of fluorine compounds.
2,742,511 (Shell Development Co.) Method for the addition of catalyst in reacting HCl with olefin.
2,742,512 (Sun Oil Co.) Alkylation of aromatic hydrocarbons.
2,742,513-4 (Sun Oil Co.) Dimerization of monoalkyl benzenes.
2,742,516 (Sun Oil Co.) Alkylation of hydrocarbons, using HF.
2,742,517 (Olin Mathieson Chemical Corp.) Selective removal of acetylene from acetylene-ethylene mixtures, using KOH in inert liquid.
2,743,212 (The Texas Co.) Process for converting carbonylation product to mixture of alcohols and acids, by reacting olefins with CO.
2,743,236 (Shell Development Co.) Foaming compositions, comprising soap and sulfated detergent solution.
2,743,264 (Air Reduction Co.) Catalytic polymerization of acetylene to cuprene by contacting with cuprous oxide.
2,743,290 (Phillips Petroleum Co.) Halogenated sulfonic acid derivatives and its preparation.
2,743,296 (Eastman Kodak Co.) Manufacture of lower aliphatic acid ahydrides from ketene.
2,743,298 (Eastman Kodak Co.) Oxo synthesis in the presence of activated carbon.
2,743,302 (Gulf Research & Development Co.) Production of alcohols by oxo process.
2,743,303 (Du Pont Co.) Process for the preparation of 1,1,4, 4-tetra-fluorobutadiene 1,3 from acetylene and tetrafluorethylene.
2,743,304 (Continental Oil Co.) Method of preparing wax substituted aromatic hydrocarbons by reacting a chlorowax with the aromatic, wherein two gram atoms of chlorine are added per mole of aromatic and the temperature is maintained below 100° C.
2,743,995 (E. H. Sargent & Co.) Method of sample burning for micro-chemical combustion analysis.
2,744,007 (Ethyl Corp.) Process of recovering alkaline earth metal from alkali metal-alkaline earth mixtures.
2,744,084 (Esso Research & Engineering Co.) Lower olefin polymerization process using hydrogenated naphtha solvent.
2,744,115 (Cities Service Oil Co.) Surface active compounds.
2,744,128 (Shell Development Co.) Olefinically unsaturated phosphates.
2,744,134 (E. I. Du Pont Co.) Preparation of aliphatic carboxylic acid amides from saturated aliphatic hydrocarbons, sulfur, water, ammonia, etc.
2,744,151 (Du Pont Co.) Conversion of methanol to hydrocarbons at superatmospheric pressure over modified metal molybdite catalysts.
2,744,199 (Esso Research & Engineering Co.) Determination of halogen in oil streams.
2,744,841 (Standard Oil Co.-Ind.) Removing polyethylene from metal surfaces with pentaerythritol.
2,744,877 (Shell Development Co.) Thermoplastic polymer compositions plasticized with certain esters of substituted, 1,5-pentanediols.
2,744,921 (Esso Research & Engineering Co.) Decobalting in oxo process using oxidizing gas and organic acid.
2,744,925 (California Research Corp.) Production of aromatic nitriles by oxidation of cyanobenzene.
2,744,928 (Shell Development Co.) Oxidation of unsaturated aldehydes to acids in presence of heteropolyacid.
2,744,929 (Shell Development Co.) Production of unsaturated carboxylic acids by oxidizing unsaturated aldehydes with selenium or tellurium dioxide.
2,744,936 (Esso Research & Engineering Co.) Oxo synthesis using cobalt salt of cobalt carbonyl.
2,744,937 (Standard Oil Co.-Ind.) Preparation of sulfone thioethers.
2,744,938 (Universal Oil Products Co.) Removal of color impurities from methoxyphenol.
2,744,939 (Standard Oil Co.-Ind.) Production of alcohols of high purity by improved oxo process.
2,744,940 (Universal Oil Products Co.) Chlorination of alkyl-cycloparaffin to monochloride.
2,744,942 (Universal Oil Products Co.) Production of nitration grade aromatics by catalytic hydroforming, solvent extraction, clay treating.

Fuels

2,741,914 (Pure Oil Co.) Automatic fuel weighing device.
2,742,349 (Ethyl Corp.) Synergistic stabilizing compositions (piperazine, etc.) for gasoline.
2,742,350 (Ethyl Corp.) Antioxidant composition and use (aminodiphenylamine, etc.) in fuels.
2,742,351 (Esso Research & Engineering Co.) Stabilized heating oil containing cracked stock with phosphate, arsenate, etc.
2,742,886 (Carl W. McPherson and Solomon P. Scholl) Fuel generator for internal combustion engines.
2,744,380 (Edward B. McMillan and Dudley F. Straubel) Method of generating jet power through sulfide reaction, by supplying burst of molten sulfide and oxidant.
2,744,126 (Du Pont Co.) Preparation of lead-sodium alloy and tetraethyllead.
2,744,814 (Charles B. Francis) Apparatus for the production of fixed gas from fuel oil by pyrolysis over metal oxide catalyst.
2,744,810 (Callery Chemical Co.) Production of compounds containing boron and hydrogen.

Lubricants

2,742,427 (Socony Mobil Oil Co.) Lubricating oil containing dispersed magnesium.
2,742,428 (General Electric Co.) Organopolysiloxane lubricants.
2,742,429 (Sinclair Refining Co.) Lubricating oil compositions containing pinene-P_2S_5 product.
2,742,430-1 (Tide Water Associated Oil Co.) Concentrates useful as additives in mineral oil compositions and mineral oil compositions containing same (P-S-N compounds).
2,742,432 (Tide Water Associated Oil Co.) Mineral oil lubricating compositions containing half-amide and amine rust inhibitors.
2,743,324 (Esso Research & Engineering Co.) Stabilized synthetic lubricant (diester and phenothiazine).
2,743,235 (Esso Research & Engineering Co.) Mineral oil composition containing P-S compound as oxidation inhibitor.
2,743,275 (Socony Mobil Oil Co.) Synthetic lubricants made by condensing olefin with pyridine, etc.
2,743,280 (Socony Mobil Oil Co.) Synthetic lubricants made by condensing olefin with thiophene.
2,743,281 (Socony Mobil Oil Co.) Synthetic lubricants made by condensing decene with dioxane.
2,744,068 (Standard Oil Co.-Ohio) Odor stabilized lubricating oil additives made by reacting mineral oil with phosphorus sulfide and treating with alkali and SO_2.
2,744,069 (Shell Development Co.) Lubricating oil additive by reacting phenate and salicylate.
2,744,070 (Continental Oil Co.) Soluble cutting oil.
2,744,071 (Esso Research & Engineering Co.) Lubricating oil additives (pour point depressing amount of polyamide).
2,744,083 (Esso Research & Engineering Co.) Metal and sulfur containing compounds and lubricants containing them.
2,744,870 (Shell Development Co.) Lubricating compositions for engines operating on high-S fuels, consisting of W/O emulsion containing water soluble salt.
2,744,871 (Shell Development Co.) Lubricating compositions for EP use containing boric acid as EP agent.
2,744,872 (The Texas Co.) Gear lubricant comprising a wide mineral oil blend and an oxidized paraffinic residuum.

Specialties

2,742,368 (Dow Corning Corp.) Stabilized and rust inhibited polymeric organosilicon composition.
2,742,369 (Calgon, Inc.) Corrosion inhibiting composition containing thiol and dehydrated phosphate.
2,742,382 (Boeing Airplane Co.) Method of annealing with a silicone oxidation scale prohibitor decomposed to finely divided silica.
2,742,392 (Gulf Oil Corp.) Insecticidal compositions containing pyrethrin and a calcium phthalamidate.
2,742,398 (Texaco Development Corp.) Method of removing deposits of wax and like materials from pipe lines by contacting with microbiological nutrient medium.
2,742,433 (Farbenfabriken Bayer A. G. F.) Heat transfer agents (tetraaryl silicate).

(To obtain more data on advertised products see page 178)

2,743,202 (Gino Amici) Antioxidizing composition for protecting metal comprising hydrocarbon, and oxidized pinene.
2,744,834 (The Texas Co.) Chlorophyll plant matter as oxidation inhibitor for wax.

Miscellaneous

2,741,830 (Esso Research & Engineering Co.) Universal engine support.
2,741,912 (Firma Hermann Sewerlin vorm. Vulkan-Werk G. m. b. h.) Apparatus for detecting gases or vapors.
2,741,916-8 (Phillips Petroleum Co.) Flowmeters.
2,741,920 (The Pure Oil Co.) Temperature compensating tire pressure gauge.
2,742,352-4 (Esso Research & Engineering Co.) Ore reduction process in fluidized system.
2,743,171 (United Gas Improvement Co.) Method for making gas rich in hydrogen and oxides of carbon.
2,744,384 (United Aircraft Corp.) Ramjet burner construction for high velocity gases.

EQUIPMENT

Processing, general

2,742,154 (Standard Oil Co.-Ohio) Thermal diffusion apparatus and method.
2,742,348 (Robert Spence and Robert J. W. Streeton) Fluid contactor apparatus.
2,742,381 (Commonwealth Scientific and Industrial Research Organization) Method and apparatus for countercurrent contacting of solids with liquids.
2,742,407 (Gulf Oil Corp.) Fractionation process and apparatus.
2,743,088 (Hudson Engineering Corp. Heat exchanger and drive transmission.
2,743,089 (Griscom-Russell Co.) Heat exchanger tube sheet leakage prevention and detection construction.
2,743,170 (U.S.A.) Solvent extraction equipment.
2,743,583 (Foster Wheeler Corp.) Heat Exchange system for power generators.
2,743,590 (L'Air Liquids, Georges Claude Societe) Method for the fractionation of gas mixtures.
2,743,709 (Combustion Engineering, Inc.) Equalizing the temperature of high-pressure boiler drum walls.
2,743,814 (Union Oil Co. of Calif.) Process and apparatus for the elutriation of solids.
2,743,915 (National Cylinder Gas Co.) Equipment for use in treating oil by steam stripping.
2,743,945 (C. A. Parsons & Co.) Heat exchanger sealing devices.
2,743,964 (Union Carbide and Carbon Corp.) Refractory-metal body scarfing pneumatic powder dispensing apparatus.
2,743,996 (Phillips Petroleum Co.) Multi-stage crystallization apparatus.
2,743,998 (Shell Development Co.) Apparatus for the catalytic cracking of hydrocarbon oils.
2,744,629 (Radio Corp. of America) Method and apparatus for processing chemicals.
2,744,730 (Foster Wheeler Corp.) Apparatus for quenching high temperature gases.
2,744,731 (Herbert Brandt) Regenerative heat exchanger.
2,744,732 (Phillips Petroleum Co.) Pebble heat exchange chamber.
2,744,733 (Foster Wheeler Corp.) Heat exchange apparatus.
2,744,812 (Babcock & Wilcox Co.) Combination furnace for incineration of residual liquor and means for disintegrating solids entrained in the liquor.
2,744,813 (Ruhrchemie A. G.) Catalytic furnace.
2,744,814 (Charles B. Francis) Apparatus for producing fixed gas from fuel oil.
2,745,388 (Universal Oil Products Co.) Multiple cell circular heater.
2,745,639 (Sun Oil Co.) Heat exchanger.
2,745,640 (American Viscose Corp.) Heat exchanging apparatus.
2,745,722 (Monsanto Chemical Co.) Apparatus for caulking catalyst bed.
2,745,723 (Houdry Process Corp.) Apparatus for converting liquid hydrocarbons.
2,745,724 (Houdry Process Corp.) Disengagement of gases from a moving bed of solid particles.
2,745,795 (Socony Mobil Oil Co.) Apparatus for introducing granular solids into a closed vessel.
2,745,861 (Albert G. Bodine, Jr.) Apparatus using resonant sound wave and sonic flame for producing carbon monoxide, synthesis gases, and synthetic hydrocarbons.

Pumps & Compressors

2,741,984 (Radio Corp. of America) Electromagnetic pumps for conductive fluids.

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absolute shut-off dependability and safety with ANNICO TEFSEAL SEATS proven in dangerous services, such as Liquid Oxygen, Fuming Nitric Acid, Liquid Nitrogen and CO2, Fuels and other FLUIDS at all pressures and temperatures —300° to +450° F.
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(To obtain more data on advertised products see page 178)

157 OIL & GAS STOCKS
Rated BUY, HOLD or SWITCH
104 United States Issues and 53 Canadian Issues

Oil and natural gas stocks are, we believe, entering a period of selectivity. There are developments indicating sharp price advances in certain issues, a sidewise trend in others, and declining prices in still others. By holding and buying the right stocks you can *save money* and make *bigger profits.*

We have just completed a thorough check of all our Ratings on 157 oil and natural gas stocks—104 United States issues and 53 Canadian issues.

Of the 157 issues, we rate 66 as fairly priced. These are marked "HOLD" for satisfactory appreciation potentials. There are, however, 50 issues which we believe have far over-shot all reasonable price targets. These are rated "SWITCH" *to save you losses over the next 6 months.*

There are 41 stocks which we believe can be bought for profit. Of these 41 stocks rated "BUY," *15 look especially attractive for purchase* within the next 30 days. Also, there are 4 issues, (2 around $10 and 2 under $5), all off-the-beaten-path, which we believe possess *unusual profit possibilities.*

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Of the 15 stocks rated "BUY" one is very special. Company may now be on the verge of duplicating a previous similar discovery which sent the stock zooming 300% in 2 years! *This is an outstanding opportunity.*

One of the "off-the-beaten-path" oils is a big "land-play" situation with, we believe, tremendous upside possibilities at very little risk. *Similar situations in the past have resulted in large and fast capital gains.*

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2,741,985 (John B. Parsons) Pressure relief for fluid pumps.
2,741,986 (B-I-F Industries, Inc.) Pumping system.
2,741,987 (Frank W. and Arthur C. Murphy) Safety means for electrically operated pumps.
2,742,901 (Sigfrid Krauthamer) Apparatus for injecting fluid under controlled pressure conditions.
2,744,470 (Jet-Heet, Inc.) Thermopump.

Instruments

2,741,911 (Hugh M. Fitzpatrick and Margaret F. Hackleroad) Gas concentration measurement.
2,741,942 (L.K.B.-Produkter Fabriksaktiebolag) Refractometer.
2,742,266 (Frank J. Voelkerding) Gas or liquid line leak detector probe.
2,742,780 (Minneapolis-Honeywell Regulator Co.) Moisture-indicating apparatus.
2,742,784 (Phillips Petroleum Co.) Flow meter.
2,742,786 (General Electric Co.) Electrical temperature responsive system.
2,742,787 (Brown & Bigelow Corp.) Thermometers.
2,743,327 (Westinghouse Electric Corp.) Fluid flow responsive apparatus.
2,743,605 (Gamlen Chemical Co.) Pipeline viscosimeter.
2,743,986 (Foxboro Co.) Industrial multi-record system.
2,744,177 (Knock A. Bar Inc.) Liquid level signaling device.
2,744,199 (Esso Research & Engineering Co.) Apparatus for determining halogen in oil streams.
2,744,411 (Lorn La Vern Spencer, Sr.) Liquid level gage.
2,745,028 (Qualitrol Corp.) Pointer bearing for indicating instruments.
2,745,059 (Consolidated Electrodynamics Corp.) Device for measuring gas pressures.
2,745,278 (U.S.A.) Apparatus for measuring density or pressure.
2,745,484 (Blaw-Knox Co.) Continuous density control of a liquid.

Valves & Fittings

2,742,053 (Dole Valve Co.) Check valve.
2,742,054 (Pittsburgh Consolidation Coal Co.) Spring biased safety valve with spring bias relieving means.
2,742,193 (Esso Research & Engineering Co.) Slide valve adapted for accurate control of the flow of finely divided granular solid materials.
2,742,764 (Weatherhead Co.) Liquid ammonia flow system and valve.
2,742,919 (General Controls Co.) Electromagnetically operated balanced pilot valve.
2,742,927 (U.S. Industries, Inc.) Thermostatic valve.
2,743,706 (Blaw-Knox Co.) Automatic locking means for fluid pressure operated devices.
2,743,737 (Andre F. Textor) Safety valve for tanks.
2,743,742 (Robinson Orifice Fitting Co.) Line blind.
2,743,898 (Esso Research & Engineering Co.) Magnetic valve for control of fluid or fluidized solids flow.
2,744,538 (Anco, Inc.) Hydraulic pressure-relief valve.
2,744,539 (Kenyon Instrument Co.) Check valve.
2,744,720 (Hermann Wilms) Rotary valve.
2,744,775 (Crane Co.) Valve construction.
2,745,254 (Kramer Trenton Co.) Fluid flow controlling device.
2,745,429 (Esso Research & Engineering Co.) Snap action regulator valve.
2,745,430 (Goodman Mfg. Co.) Automatic pressure throttling valve for fluid pressure systems.
2,745,431 (Garett Corp.) Spring rate compensating device for relief valves and actuators.
2,745,432 (High-Pressure Components, Ltd.) Non-return valves.
2,745,626 (Hieatt Engineering Co.) Pilot controlled valve for sub-atmospheric and other low pressures.
2,745,627 (Kel-Win Mfg. Co.) Manual and automatic valves.
2,745,629 (American La France Corp.) Valve locking mechanism.

Miscellaneous

2,742,014 (Atlantic Refining Co.) Storage tank overflow alarm.
2,742,227 (Phillips Petroleum Co.) Electrical computer for solving simultaneous equations.
2,742,970 (Ansul Chemical Co.) Apparatus and method for fluidizing fire-extinguishing dry chemicals.
2,743,604 (Denison Engineering Co.) Apparatus for hydrostatically testing open-ended containers.
2,744,651 (Crane Co.) Pressure vessel.
2,745,514 (Louis W. Milos) Continuous lubricant supply for bearings.

Beckman Forms Data Department

Beckman Instruments, Inc., has set up a special data and control systems department to work on automatic data processing and the ultimate linking of instrumentation with digital computers.

Manager of the new department is Taylor C. Fletcher, who was manager of Beckman's industrial instruments group. Two other men just assigned are William F. Gunning and J. Herbert Brown. Gunning, assistant chief project engineer, has previously worked with the Rand Corp. and Douglas Aircraft Co. Brown has been working with computers at Massachusetts Institute of Technology.

The new department is currently working on two new Beckman data systems. One is particularly developed for chemical and petroleum processing and similar industries where process monitoring can vary from one to 10 samples per second. The other is a high-speed sampling system.

The department will also design, manufacture and sell data components, in addition to complete systems.

Du Pont Division Appoints

Robert F. Harwick has been appointed manager of the western region of Du Pont Co.'s Petroleum Chemicals Division. He was formerly assistant manager of the Akron district of the Elastomers Division, sales promotion manager of the Petroleum Chemicals Division, and Gulf Coast assistant regional manager of the division.

Mr. Harwick

George L. Tyler has been named assistant manager of the western region. William B. Gest has become manager of the newly created Cleveland, Ohio, district.

Edison D. Jeffus, formerly manager of the eastern regional laboratory, has been given the new post of additives manager of the Gulf Coast region, with headquarters in Houston. William W. Wingate has been moved to the other new position of additives manager for the mid-continent region, located in Tulsa. Richard O. Braendle has become manager of additive sales in Wilmington, Mr. Wingate's old post.

NEW IRON AND STEEL VALVE PLANT is latest step in Lunkenheimer Co.'s plan to consolidate all manufacturing at the Fairmount, Ohio, site. This 400-ft machine bay occupies an entire side of the two-story plant, which is adjacent to the company's bronze factory.

William K. Park has been transferred from the central region to the eastern region as an account manager, with headquarters in New York.

Foxboro Expands Sales Activities

Foxboro Co. has appointed six application engineers to sales promotion posts in the home office, to expand the company's application engineering service to instrument users in industry.

Heading activities of the chemical industries sales division is V. A. Pardo, who was with Foxboro's Philadelphia branch office. Also, J. M. Petrillo has been moved to the chemical group. He has served in the metals industries division since 1949. R. C. Tamm has replaced him.

E. N. Hayes has been appointed manager of the refinery industries sales division. Hayes was a sales engineer with the company in Houston. Before coming to Foxboro, he was with Phillips Petroleum Co. as a refinery process engineer.

New men in the power and metals industries sales divisions are C. R. Fleming and J. W. Pierce.

New Procon Subsidiary

Procon Incorporated has opened a new subsidiary, Procon International, S.A., to handle petroleum processing construction activities outside the U.S.

While its operations are expected to center on South America, the new corporation's first major job is to construct a 20,000 b/d refinery in Cuba for The Texas Co.

Procon International will have headquarters in Chicago and a branch office in Santiago de Cuba. C. B. Whyte, president of Procon, also heads the new subsidiary. J. C. Reed and A. G. Petkus are vice-presidents.

Houston U. Plans Data Center

A computing and data processing center is being established on the campus of the University of Houston as a service to the processing industries and others in the area.

With a staff of experts in accounting, engineering and mathematics, the center will teach and coordinate courses in data processing, computing and applications of computing machines.

In addition, the school offers consultant services and the services of trained numerical analysts, programmers, engineers and specialists in applying computers to industry problems.

Delivery of an IBM 650 data processing machine is scheduled for August. The machine and allied equipment will serve as the center's laboratory.

Davison Names Canada Head

William B. Davis has been named manager of the Davison Chemical Co.'s new catalyst plant at Valleyfield, near Montreal, Canada. The plant will be completed in April of 1957.

Mr. Davis has been staff assistant to F. C. Nicholson, vice-president of operations at Davison. He has also

REFINING PROCESSES

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made possible with

MOLECULAR SIEVES

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Several graduate engineers with minimum 5 years' experience supervising maintenance engineering functions in oil refining or producing facilities, power plants, heavy industrial installations, manufacturing plants or related operations. To establish technical supervision, procedures, maintenance operations and schedule routine and special work for major oil producing and refining operation with all supporting facilities; i.e., housing, feeding, recreation, etc.

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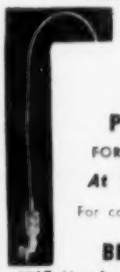

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Established manufacturer of industrial processing materials has opening for a special representative in the Great Lakes Region.

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been superintendent of the company's sulfuric acid plant at the Curtis Bay works, and production manager at Curtis Bay.

Mr. Clarke

Mr. Bratton

Bratton, Clarke Now With Kellogg

W. E. Bratton and Ralph L. Clarke have joined the M. W. Kellogg Co. and will handle engineering and construction contracts in the petroleum and petrochemical fields.

Mr. Bratton was formerly head of the Lummus Co.'s contract department. Before this he served as Lummus's special representative in Washington for two years. He is a graduate of the Air Command and Staff School of the Air University, Maxwell Air Force Base.

Ralph Clarke comes to Kellogg from the Badger Process Division of Stone & Webster Engineering Corp. Previously he was with the gasoline plant division of American Republics Corp., Houston. He is a graduate of the University of Tulsa. As a petroleum engineer,

Strub Joins Fluor Corp.

Paul T. W. Strub has become assistant to J. S. Fluor, president of Fluor Corp., Ltd. Strub was formerly assistant to the president of Calor Gas Co.

From 1939-46 he was with Standard Oil of New Jersey, and then joined the Reconstruction Finance Corp. In 1952-53 Mr. Strub was with Great Lakes Carbon, then moved to Calor Gas.

Personnel Changes

Worthington Corp.—E. C. Schmachtenberg, from assistant to the manager of engineering and chief engineer, compressors, to assistant to the manager of engineering; Hunt Davis, from chief engineer, compressor development, to chief engineer, compressors; C. A. Macaluso, from assistant manager of research and development to assistant chief engineer, compressors; W. F. Donovan, from group supervisor in research and development to

assistant manager of R&D. All are in the engineering department, Harrison Division.

Lukens Steel Co.—Joseph H. Proctor to manager of marketing service, succeeding Hambleton Shepperd, who has advanced to manager of advertising and sales promotion.

Lubrizol Corp.—Dr. T. W. Mastin, director of research and development to vice-president in charge of the R&D division; M. R. Clapp, assistant manager of the manufacturing division, to the board of directors, succeeding C. L. Stone, retired.

Perkin-Elmer Corp.—Paul C. Hutchinson to director of sales of the instrument division.

Dresser Industries, Inc.—William S. Andrews to manager of general markets sales of Dresser Manufacturing Division.

Fischer & Porter Co.—Philip E. Sellers, from sales manager to sales vice-president; Herman Kockritz, from southeastern divisional manager to field sales manager; and William Trethaway, from sales engineer to district manager of the Atlanta office.

Carrier Corp.—Arnold B. White to coordinator of engineering standards.

Girdler Co.—W. Roberts Wood to president, succeeding George O. Boomer, retired.

Robertshaw-Fulton Controls Co.—Charles D. Branson to assistant director of research.

Chicago Bridge & Iron Co.—R. F. Hendren, manager of plants, to vice-president. He became a director in 1946 and manager of plant in 1947.

Expansion, Transition

Fisher Governor Co. has purchased the Control Specialty Corp., Houston, Texas, manufacturers of lease automation equipment, tank switches, well testers and other products.

Rhodia, Inc., has moved to new and larger offices in New York City. Now located at 60 E. 56th St., with phone number PLaza 3-4850, company has space for expansion of "Alamask" industrial reodorants and other divisions.

Branches, Distributors

Dearborn Chemical Co. has opened a district office at 5526 Dyer St., Dallas, which will handle sales for Texas, Louisiana, Arkansas, Oklahoma, New Mexico, and most of Kansas. E. M. Welch has been appointed southwestern district manager and will head the new office.

Rhodia, Inc., has appointed Klenzade Products Co., Beloit, Wis., sales and service representatives for "Alamask" industrial reodorants in the central states.

Cooper Alloy Corp. has begun construction of new buildings at both the Hillside and Clark Township, N.J., plants. Over-all cost of expansion is estimated to be $500,000.

Beckman Instruments, Inc., has acquired Lou-Bar Products, manufacturers of precision components for automatic control systems.

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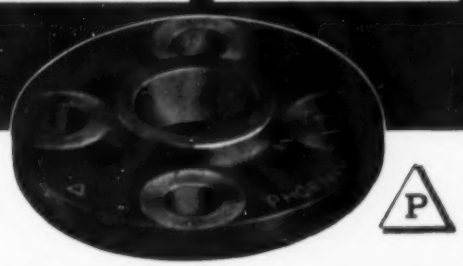

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(To obtain more data on advertised products see page 178)

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The BS&B Type 76-16 Tank Vent is a lightweight venting device for atmospheric storage tanks containing volatile fluids, and features a floating seal which provides positive shut-off under both pressure and vacuum. This seal consists of two flexible diaphragms which contact valve seats. Easy access is provided to it by a quick-opening V-clamp which holds the cover in place. These vents mount to ASA bolting circles in sizes 4" through 12". Pressure and vacuum settings start at ½ ounce per sq. in.

The BS&B Type 76-18 In-Line Arrestor is for a free vent system, requiring a flame arrestor to protect vent lines on process vessels when the emitted vapors are explosive or ignitible. End flanges are 150 lb. ASA in sizes 4" through 12".

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The Process Industries in a Nutshell

The Chemical Process Industries, 2nd ed., by R. Norris Shreve, 1956, 6¾ x 9¼ in., 1004 pages, indexed, illustrated, stiff cloth cover, $11.50, McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N.Y.

THE importance of chemical engineering underlying the chemical process industries is highly emphasized in the new expanded edition of *The Chemical Process Industries* by Professor Shreve. Literature references have been brought up to date and flow sheets and statistics checked.

Designed as either a college text or reference book for the practicing engineer or chemist, the book's authenticity has been implemented by having chapters or parts of chapters submitted to experts for checking.

Portions of this book of special interest to the petroleum processing industries cover: fuel gases; industrial carbon; sulfur and sulfuric acid; nitrogen industries; paint, varnish, lacquer and allied industries; synthetic fibers; plastics; natural and synthetic rubber; and the petroleum industry.

Many other industries or products are also covered in the book: fuels; power and air conditioning; industrial gases; ceramics; cements, calcium and magnesium compounds; glass; salt and miscellaneous sodium compounds; soda ash, caustic soda and chlorine; electrolytic industries; electrochemical industries and phosphorus industries; etc.

Two chapters of general interest to all industries cover general fundamentals (materials of construction, instrumentation, safety, patents, research, waste disposal, etc.), water conditioning and waste-water treatment.

There is a liberal use of illustrations, flow diagrams and photographs. In order not to confuse the college student with too much detail, the flow diagrams are relatively simple. However, for the reader desiring more information, references are made to the more detailed, pictured flow sheets in *Chemical Engineering*. Also for the practicing engineer, there are liberal literature references for further study.

Recent Books Briefly Noted

Reactor Handbook, 1955—consists of three volumes, each 8 x 10½ in., illustrated, stiff cloth cover, indexed; **Engineering,** 1075 pp., $15.00; **Materials,** 610 pp., $10.50; and **Physics,** 790 pp., $12.00; prepared by U.S. Atomic Energy Commission, McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N.Y.

. . . contains information relating to industrial power reactors and summarizes accomplishments of the U. S. Atomic Energy Commission's nuclear reactor program to date.

Tables of Thermal Properties of Gases, National Bureau of Standards Circular 564, by J. Hilsenrath, C. W. Beckett, W. S. Benedict, L. Fano, H. J. Hoge, J. F. Masi, R. L. Nuttall, Y. S. Touloukian and H. W. Woolley, 1955, 478 pp., $3.75, order from Government Printing Office, Washington 25, D.C.

. . . covers thermodynamic and transport properties of air, argon, carbon dioxide, carbon monoxide, hydrogen, nitrogen, oxygen and steam.

AGA Flow Constants, by L. K. Spink, 1956, 8½ x 11 in., 111 pages, tabular material, paper cover, $10.00, The Foxboro Co., Foxboro, Mass.

. . . manual of tabular AGA flow constants for orifices where flange taps are used, contains total of 77,811 separate flow calculations evaluated to six figures covering values of S for an infinite Reynolds number, E, K_v, and other constants.

Elevated-Temperature Properties of Carbon Steels, ASTM Special Technical Publication No. 180, prepared by W. F. Simmons and H. C. Cross, 1955, 9 x 12 in., 68 pp., illustrated, table of contents, paper cover, $3.75, American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

. . . fourth publication in a current series under auspices of the ASTM-ASME Joint Committee on the Effect of Temperature on the Elevated Temperature Properties of Metals. Gives common properties (tensile, yield, elongation, etc.) in graphical form with copies of original data sheets.

Temperature—Its Measurement and Control in Science and Industry, edited by H. C. Wolfe, 1955, 6½ x 9¼ in., 467 pp., illustrated, indexed, stiff cloth cover, $12.00, Reinhold Publishing Corp., 430 Park Ave., New York 22, N.Y.

. . . reference book of the proceedings (24 papers) of the Third International Symposium on Temperature sponsored by the American Institute of Physics, the National Bureau of Standards and the Office of Ordnance Research, U.S. Army.

Design of Piping Systems, 2nd ed., by members of engineering departments of the M. W. Kellogg Co., 1956, 9 x 11¼ in., 365 pages, indexed, illustrated, stiff cloth cover, $15.00, John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y.

. . . covering strength and failure of materials, design assumptions, stress evaluation, design limits, local components, simplified method for flexibility analysis, flexibility analysis by the general analytical method and model test, vibration prevention and control, etc.

The United States Patent System, by Floyd L. Vaughan, 1956, 6¼ x 9¼ in., 355 pages, indexed, stiff cloth cover, $8.50, The University of Oklahoma Press, Publishing Div. of the University, Norman, Okla.

. . . evaluates the complex patent system of the United States in terms of the public interest and a thorough analysis of the legislation and litigation that have surrounded the patent system's growth.

Transactions of 20th Annual Meeting, Industrial Hygiene Foundation, Bulletin No. 29, 1956, 6 x 9 in., 274 pages, table of contents, illustrated, paper cover, $5.00, Industrial Hygiene Foundation of America, Inc., Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa.

. . . covering the medical, chemical-toxilogical, joint medical and chemical-toxicological, legal, engineering and legal conferences at the Nov. 1955 meeting, Pittsburgh, Pa.

Mass-Transfer Operations, by Robert E. Treybal, 1955, 6¼ x 9¼ in., 666 pages, indexed, illustrated, stiff cloth cover, $9.50, McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 36, N.Y.

. . . introduction to general features of diffusion and the techniques used in the industrial applications of mass transfer operations.

Minerals Yearbook Area Reports, Vol. III, by U.S. Department of Interior, Bureau of Mines, 1952, 6 x 9¼ in., 1050 pages, indexed, illustrated, stiff cloth cover, $3.75, Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

. . . covers all 48 states, Alaska, the Territories and island possessions in the Pacific Ocean and Caribbean Sea, including the Canal Zone.

Metals Handbook, 1955 Supplement, edited by Taylor Lyman, 1955, 8½ x 11 in., 208 pp., illustrated, indexed, stiff cloth cover, $6.00, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

. . . written by 179 specialists and has 214 tables, 256 charts, 411 illustrations. Gives practical information on wide variety of metal-working subjects in its 21 articles on metals and applications, design and application, processing and fabrication, and testing and inspection.

This is it...

the fast, efficient all-in-one pipe and bolt threader

... threads, cuts, reams!

Capacity: ⅛" to 2" pipe; ¼" to 2" bolts or rod.

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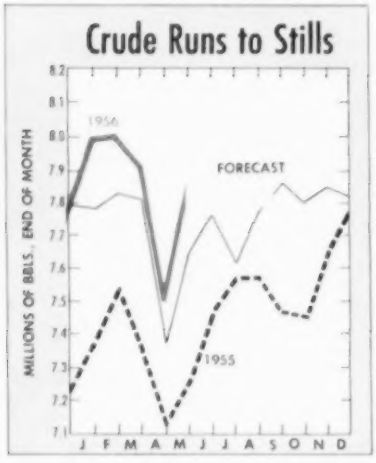
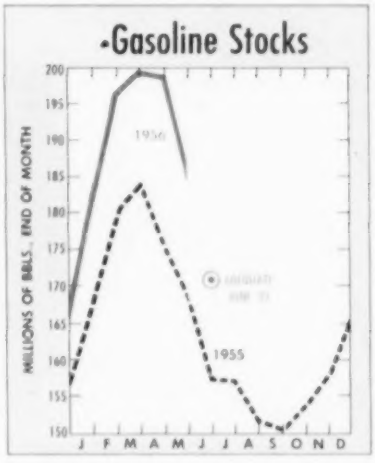
"Threaded Pipe—*It's Tight—It's Best—Costs Less*"

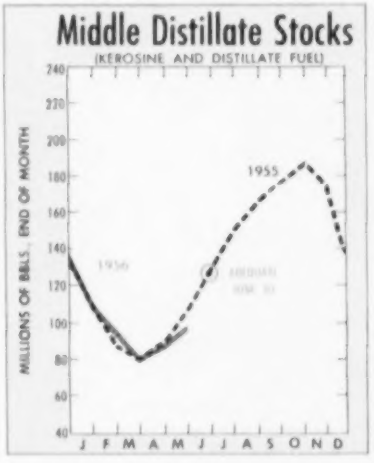
500A with SPEED CHUCK ... more clean smooth threads with less work ... a real work-saver in your refinery

New type wrenchless Speed Chuck operates easily, quickly, guaranteed to grip pipe or rod tightly—forward, reverse; jaws have replaceable insert teeth for longer life . . . Independent die heads, cutter, reamer swing up out of way when not in use; you can chuck pipe easily from front. All quick-opening die heads—any combination of sizes to meet your needs, Quadri, Dual or Mono heads for ⅛" to 2" pipe . . . quick size change right in machine . . . Power for geared tools to 12". Many other efficient worksaver features. See it, try it . . . buy it—at your Supply House.

The Ridge Tool Company, Elyria, Ohio, U. S. A.







High Runs Slow "Gas" Inventory Cuts

OUTLOOK: For U. S. distillate fuel oil stocks to be close to 150,000,000 bbl by Sept. 30.

AT the normal trend in operating rates in U. S. refineries, gasoline inventories are not likely to be reduced in the third quarter by the volumes some authorities believe desirable to bring supply and demand into balance by fall.

Second quarter crude charges to stills averaged approximately 7,650,000,000 b/d, it is indicated, about 40,000 bbl higher than the earlier forecast for this period. Indicated gasoline demand in this quarter is 4,100,000 bld avg., and the reduction in stocks through May was at a lower rate than a year ago.

For the third quarter, crude runs of 7,850,000 b/d avg. are currently forecast, and normally runs are increased in this period. This year, however, gasoline demand is estimated to be the same for the third quarter as for the second, 4,100,000 bbl daily. With higher crude runs and the same gasoline demand, withdrawals from stocks may continue to be relatively low. An adequate stock level June 30 would be around 171,000,000 bbl, 13,000,000 bbl higher than 1955.

In the past years, gasoline demand has been higher in the third than in the second quarter, although the difference has been narrowing, due largely to the spreading of summer touring over more months.

Distillate fuel oil demand in the second quarter, 1,295,000 b/d avg., was about 140,000 bbl daily higher than actual demand in this period in 1955, and stock increases were at a much slower rate this year. At the rate of distillate fuel oil demand currently forecast for the third quarter, and with higher crude runs, distillate inventories should build up rapidly in the third quarter. Adequate inventory level Sept. 30 would be around 146,500,000 bbl.

MAY KEY STATISTICS

(Figures given in terms of millions of b/d, monthly averages, except stocks, which are in millions of bbl at end of month)

	May 1956	Apr. 1956	May 1955
CRUDE OIL			
U. S. Production	7.057	7.141	6.677
Imports	.883	.866	.742
U. S. Stocks		274.064	276.948
Runs to Stills	7.865	7.501	7.268
GASOLINE			
Refinery Output	3.712	3.581	3.508
Refinery Demand	3.988	3.969	3.827
Primary Stocks	184.676	189.773	168.751
MIDDLE DISTILLATES			
Refinery Output	1.998	2.029	1.815
Refinery Demand	1.435	1.969	1.237
Primary Stocks	98.341	80.898	109.934
RESIDUALS			
Refinery Output	1.171	1.139	1.111
Imports & Other	4.61	.452	.374
Total Supply	1.632	1.606	1.485
Refinery Demand	1.554	1.644	1.444
Primary Stocks	34.991	32.582	45.083

PRODUCT AND CRUDE PRICES

(Products—¢ gal, weighted average prices in principal refinery markets
Crudes—$ bbl, principal fields
Source—Platt's Oilgram Price Service)

	May 1956	Apr. 1956	May 1955
Gasoline (regular)	12.01	11.76	11.33
Distillate Fuel Oil	9.36	9.40	9.11
Kerosine	10.93	10.95	10.51
Residuals	5.19	5.19	4.36
Above 4 Products	9.51	9.40	8.86
Lube Oils	22.45	22.40	16.83
Crude	2.84	2.84	2.82

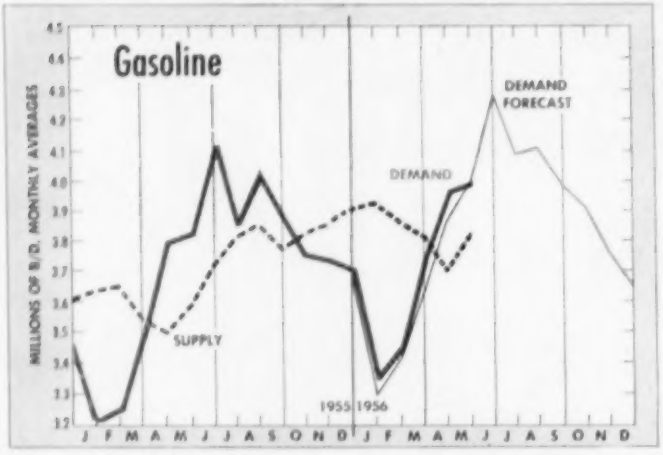
REFINERY YIELDS

% on Crude Runs to Stills

	May 1956	Apr. 1956	May 1955
Gasoline	43.2	43.8	43.9
Kerosine	3.7	4.1	4.1
Distillate	21.7	22.9	21.0
Residuals	14.9	15.2	15.3

SOURCE OF DATA (except prices): Apr. and May, API weekly reports; earlier months, Bureau of Mines

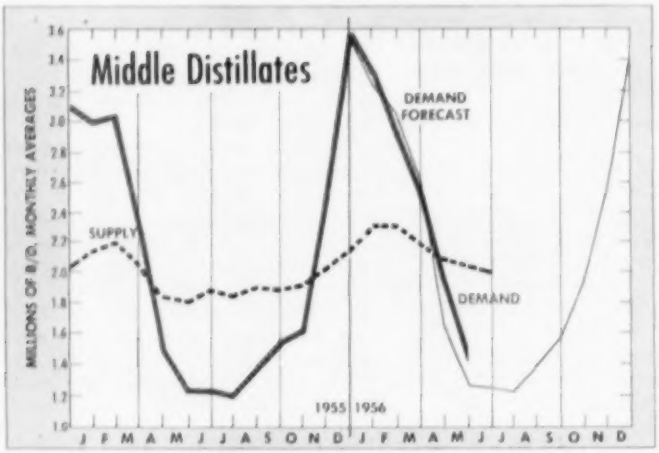
Volume of Gasoline Output Is Stepped Up



MOTOR FUEL

	From Crude	From Nat. Gas	Total
SUPPLY (Millions of b/d)			
May '56	3.398	.429	3.827
May '55	3.184	.411	3.595
Change	+ .214	+ .018	+ .232
% Change	+ 6.7	+ 4.4	+ 6.5
DEMAND (Including Exports) (Millions of b/d)			
May '56			3.988
May '55			3.827
Change			+ .161
% Change			+ 4.2
TOTAL SUPPLY (Millions of bbl)			
5 Mos. '56	516.669	65.034	581.703
5 Mos. '55	478.559	62.957	541.516
Change	+ 38.110	+ 2.077	+ 40.187
% Change	+ 8.0	+ 3.3	+ 7.4
TOTAL DEMAND (Including Exports) (Millions of bbl)			
5 Mos. '56			561.684
5 Mos. '55			530.015
Change			+ 31.669
% Change			+ 6.0

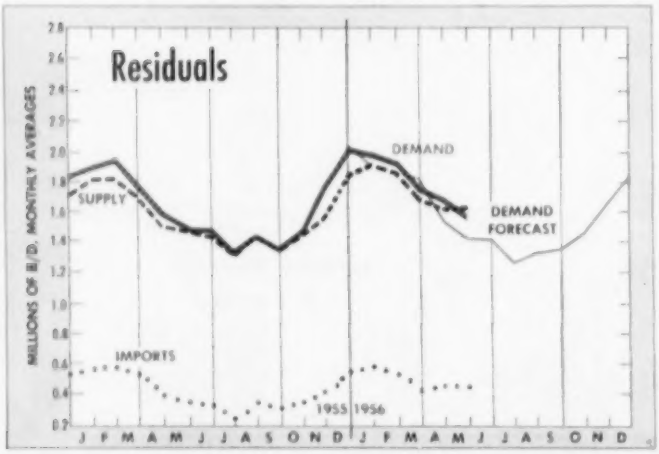
Distillate Demand Drops to Seasonal Level


Middle Distillates
DEMAND FORECAST
SUPPLY
DEMAND
1955 1956
MILLIONS OF B/D. MONTHLY AVERAGES
J F M A M J J A S O N D J F M A M J J A S O N D

MIDDLE DISTILLATES

	Kerosine	Dist. Fuel Oil	Total
PRODUCTION (Millions of b/d)			
May '56	.293	1.705	1.998
May '55	.296	1.519	1.815
Change	− .003	+ .186	+ .183
% Change	− 1.0	+ 12.3	+ 10.0
DEMAND (Including Exports) (Millions of b/d)			
May '56	.176	1.259	1.435
May '55	.138	1.099	1.237
Change	+ .038	+ .160	+ .198
% Change	+ 27.5	+ 14.6	+ 16.0
TOTAL PRODUCTION (Millions of bbl)			
5 Mos. '56	52.048	275.739	327.787
5 Mos. '55	52.753	251.551	304.304
Change	− .705	+ 24.188	+ 23.483
% Change	− 1.3	+ 9.6	+ 7.7
TOTAL DEMAND (Including Exports) (Millions of bbl)			
5 Mos. '56	57.821	313.983	371.804
5 Mos. '55	54.204	278.055	332.259
Change	+ 3.617	+ 35.928	+ 39.545
% Change	+ 6.7	+ 12.9	+ 11.9

Residual Fuel Shipments Close to 1955 Rate


Residuals
DEMAND
SUPPLY
DEMAND FORECAST
IMPORTS
1955 1956
MILLIONS OF B/D. MONTHLY AVERAGES
J F M A M J J A S O N D J F M A M J J A S O N D

RESIDUAL FUELS

	Refinery Output	Imports & Other	Total
SUPPLY (Millions of b/d)			
May '56	1.171	.461	1.632
MaMy '55	1.111	.374	1.485
Change	+ .060	+ .087	+ .147
% Change	+ 5.4	+ 23.2	+ 9.8
DEMAND (Including Exports) (Millions of b/d)			
May '56			1.554
May '55			1.444
Change			+ .110
% Change			+ 7.6
TOTAL SUPPLY (Millions of bbl)			
5 Mos. '56	187.054	77.323	264.377
5 Mos. '55	177.395	75.078	252.473
Change	+ 9.659	+ 2.245	+ 11.904
% Change	+ 5.4	+ 3.0	+ 4.7
TOTAL DEMAND (Including Exports) (Millions of bbl)			
5 Mos. '56			269.289
5 Mos. '55			259.495
Change			+ 9.794
% Change			+ 3.8

SOURCE OF DATA: Apr. and May, API weekly reports; earlier months, Bureau of Mines

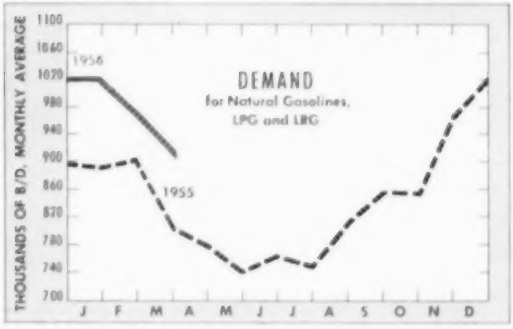
RUNS TO STILLS and DISTRIBUTION OF PRIMARY STOCKS BY U. S. REFINERY DISTRICTS

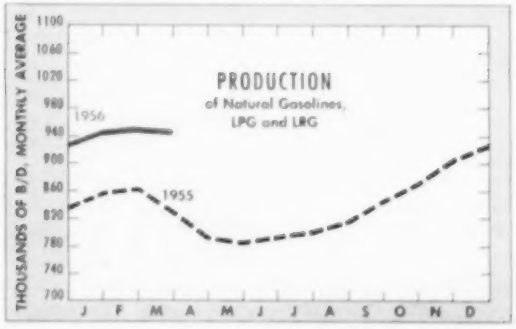
(Primary stocks include those at refineries, at large terminals and in pipelines; all data based on API reports)

District	RUNS TO STILLS (Millions of b/d average for week ending on date shown) May 25 1956	May 27 1955	Change	% Change	GASOLINE STOCKS (Millions of bbl., on date shown) May 25 1956	May 27 1955	Change	% Change	RESIDUAL STOCKS (Millions of bbl., on date shown) May 25 1956	May 27 1955	Change	% Change
East Coast	.956	1.115	— .159	—14.3	40.130	36.979	+ 3.151	+ 8.5	8.267	8.495	— .228	— 2.8
Gulf Coast	2.736	2.504	+ .232	+ 9.3	34.632	34.603	+ .029	—	6.740	5.638	+ 1.102	+19.5
Total Coastal	3.692	3.619	+ .073	+ 2.0	74.762	71.582	+ 3.180	+ 4.4	15.007	14.133	+ .874	+ 6.2
Appalachian	.189	.177	+ .012	+ 6.8	7.305	7.196	+ .109	+ 1.5	.471	.549	— .078	—14.2
Ind.-Ill.-Ky.	1.354	1.372	— .018	— 1.3	34.488	34.736	— .248	— 0.7	3.984	3.912	+ .072	+ 1.8
Okla.-Kans.-Mo.	.702	.651	+ .051	+ 7.8	17.292	16.120	+ 1.172	+ 7.3	1.050	.809	+ .241	+29.8
Other Inland	.761	.610	+ .151	+24.8	25.177	17.753	+ 7.424	+ 4.2	2.513	2.102	+ .411	+19.6
Total Inland	3.006	2.810	+ .196	+ 7.0	84.262	75.805	+ 8.457	+11.5	8.108	7.372	+ .646	+ 8.8
Total East of Calif.	6.698	6.429	+ .269	+ 4.2	159.024	147.387	+11.637	+ 7.9	23.025	21.505	+ 1.520	+ 7.1
California	1.099	1.054	+ .045	+ 4.3	24.486	21.996	+ 2.500	+11.4	11.762	22.651	—10.889	—48.1
Total U. S.	7.797	7.483	+ .314	+ 4.2	183.510	169.373	+14.137	+ 8.3	34.787	44.156	— 9.369	—21.2

District	DISTILLATE FUEL OIL STOCKS (Millions of bbl., on date shown) May 25 1956	May 27 1955	Change	% Change	KEROSINE TOCKS (Millions of bbl., on date shown) May 25 1956	May 27 1955	Change	% Change	TOTAL MIDDLE DISTILLATE STOCKS (Millions of bbl., on date shown) May 25 1956	May 27 1955	Change	% Change
East Coast	20.433	26.536	— 6.103	—23.0	7.990	10.616	— 2.626	—24.7	28.423	37.152	— 8.729	—23.5
Gulf Coast	15.734	13.684	+ 2.050	+15.0	5.412	5.015	+ .397	+ 7.9	21.146	18.699	+ 2.447	+13.1
Total Coastal	36.167	40.220	— 4.053	—10.1	13.402	15.631	— 2.229	—16.6	49.569	55.851	— 6.282	—11.2
Appalachian	1.902	2.460	— .558	—22.4	.889	.773	+ .116	+15.0	2.791	3.233	— .442	—13.7
Ind.-Ill.-Ky.	9.895	15.056	— 5.161	—34.3	3.503	5.757	— 2.254	—39.2	13.398	20.813	— 7.415	—35.6
Okla.-Kans.-Mo.	7.408	8.799	— 1.391	—15.8	1.037	1.300	— .263	—20.2	8.445	10.099	— 1.654	—16.4
Other Inland	7.870	5.012	+ 2.858	+57.0	1.431	1.410	+ .021	+ 1.5	9.301	6.422	+ 2.879	+44.8
Total Inland	27.075	31.327	— 4.252	—13.6	6.860	9.240	— 2.380	—25.8	33.935	40.567	— 6.632	—15.3
Total East of Calif.	63.242	71.547	— 8.305	—11.6	20.262	24.871	— 4.609	—18.5	83.504	96.418	—12.914	—13.4
California	8.785	8.657	+ .128	+ 1.5	.437	.349	+ .088	+25.2	9.222	9.006	+ .216	+ 2.4
Total U. S.	72.027	80.204	— 8.177	—10.2	20.699	25.220	— 4.521	—17.9	92.726	105.424	—12.698	—12.0

Natural Gas and Refinery Gas Liquids





SUPPLY AND DEMAND STATISTICS
(Bureau of Mines Data)

CURRENT PRODUCTION (1000 b/d monthly average)	Mar. 1956	Feb. 1956	Mar. 1955
At Natural Gasoline and Cycling Plants			
Liquefied Petroleum Gas	436	435	361
Natural Gasoline and Isopentane	285	278	275
Condensate	22	29	21
Finished Gasoline, Naptha and other	67	64	63
Total Natural Gasoline and Cycling Plant Production	800	806	720
Liquefied Refinery Gases	137	143	111
Total Marketable Gas Liquids	937	949	831
Lease Condensate	129	129	114
Total Natural Gas liquids	1,066	1,078	945
CURRENT DEMAND (1000 b/d monthly average)			
LPG and LRG	531	589	452
Natural Gasoline, Isopentane and Other	365	370	349
Total Marketable Gas Liquids	896	959	801
CUMULATIVE PRODUCTION (1000 bbl.)		Mar. 1956	Mar. 1955
LPG and LRG		52,127	44,347
Natural Gasoline, Isopentane and Other		33,814	32,355
Total Marketable Gas Liquids		85,941	76,702
CUMULATIVE DEMAND (1000 bbl.)			
LPG and LRG		54,114	45,983
Natural Gasoline, Isopentane and Other		33,089	31,647
Total Marketable Gas Liquids		87,203	77,630

STOCKS (1000 bbl., end of month)	Mar. 1956	Feb. 1956	Mar. 1955
LPG and LRG	5,751	4,742	6,122
Natural Gasoline, Isopentane and Other	5,209	4 946	5,365
Total Stocks	10,960	9,688	11,487

Information Offered in the Advertisements

Do you need detailed information on a specific subject? Check through this easy-to-use index of literature and data being offered in this issue's advertisements.

AGITATORS, side entering, outside packed, bulletin; Patterson Foundry & Machine Co. See adv't. p. 146.

ANALYSIS of process streams, continuous, refractometer, data sheets; Barnes Engineering Co. See adv't. p. 164.

ANALYZER, gas and liquid, bulletin 831; Burrell Corp. See adv't. p. 206.

BATCHING EQUIPMENT, available jacketed, bulletin F1-56 & J-56; Hetherington & Berner, Inc. See adv't. p. 177.

CATALYSTS, for special process requirements, booklet; Harshaw Chemical Co. See adv't. p. 1.

CENTRIFUGE, for continuous solids removal, bulletin 930; The Pfaudler Co. See adv't. p. 131.

CLEANING & STRIPPING, chemicals, booklet F 7629; Oakite Products, Inc. See adv't. p. 202.

COMBUSTION UNITS, vertical and horizontal, oil or gas fired, bulletin; National Airoil Burner Co., Inc. See adv't. p. 144.

COMPRESSORS, centrifugal, for gases, booklet; Carrier Corp. See adv't. p. 67.

CONSERVATION VENT, for tanks, bulletin 522; Johnston & Jennings Co. See adv't. p. 17.

DATA SYSTEMS, for pilot plants, data file D-1-23; Beckman Instruments, Inc. See adv't. p. 51.

DRYER-BIENDER, glass lined, for corrosive products, data sheet 26; The Pfaudler Co. See adv't. p. 131.

ELECTRICAL SYSTEMS, distribution and control, bulletin GED-2244; General Electric Co. See adv't. pp. 36-37.

ETHANOLAMINES, for gas treating, information; Nitrogen Div., Allied Chem. & Dye Corp. See adv't. p. 134.

EXPANSION JOINTS, catalog; Solar Aircraft Co. See adv't. p. 58.

FITTINGS, catalog; Crawford Fittings Co. See adv't. p. 177.

FLANGES, drop-forged, brochure; Phoenix Mfg. Co. See adv't. p. 169.

FLEXIBLE COUPLIGS, and expansion joints, "Teflon," catalog EJ-1155; U. S. Gasket-Belmont Packing. See adv't. p. 204.

FLOW ALARM, magnetic Float, catalog 10-A-84; Fischer & Porter Co. See adv't. p. 198.

FRANGIBLE DISCS, for hydraulic or gaseous systems, catalog; Frangible Discs, Inc. See adv't. p. 177.

FURFURAL, for solvent extraction, bulletin 203-A; Quaker Oats Co. See adv't. p. 38.

GRADIATION HEATING, bulletin 97; Selas Corp. of America. See adv't. p. 47.

HEAT EXCHANGERS, evaporative cooling, bulletins 120 & 124; Niagara Blower Co. See adv't. p. 196.

HOT PLATE, laboratory use, bulletin 1001-A; Lindberg Engineering Co. See adv't. p. 194.

INSULATION, industrial, sheets, brochures IN-121A & IN-173A; Johns-Manville Corp. See adv't. p. 207.

MATERIALS HANDLING, trucks, electric, bulletins; Baker-Raulang Co. See adv't. p. 40.

MIST ELIMINATORS, for separation of entrained liquids, bulletin ME-106; Metal Textile Corp. See adv't. p. 185.

MIXERS, side entering, top entering, eight catalogs; Mixing Equipment Co. See adv't. p. 68.

OCTANE STUDIES, technical paper; Ethyl Corp. See adv't. pp. 4-5.

PAINT, tank enamel, booklet; Finishes Div., DuPont Co. See adv't. p. 22.

pH MEASUREMENT, in process streams under pressure, bulletins; Beckman Instruments, Inc. See adv't. p. 145.

PIPE, saran lined, for corrosive service, information; Dow Chemical Co. See adv't. p. 52.

PROCESS EQUIPMENT, fabrication, booklet; Newport News Shipbuilding & Drydock Co. See adv't. p. 63.

PUMPS, vertical, for wet-pit service, bulletin 110; Bingham Pump Co. See adv't. p. 61.

PUMP, rotary, stainless steel, bulletin VP561; Cooper Alloy Corp. See adv't. p. 186.

ROTAMETERS, safety shielded, bulletin 115; Brooks Rotameter Co. See adv't. p. 188.

STEAM TRAPS, bulletin 10-55; W. H. Nicholson & Co. See adv't. p. 32.

TANK HEATERS, vertical mounting, bulletin 561; Brown Fintube Co. See adv't. p. 55.

TUBE CUTTERS, air and electric drive, bulletin 59; Airetool Mfg. Co. See adv't. p. 156.

TUBE REPAIR inserts, bulletin and report; Condenser Service & Engineering Co., Inc. See adv't. p. 192.

TUBES, for protection of Thermocouples, bulletin 11-13; Claud S. Gordon Co. See adv't. p. 163.

TURBINES, high speed, compressor drive, bulletin 1966; Worthington Corp. See adv't. pp. 100-101.

UNLOADING TANK CARS, six bulletins cover several chemicals and acids; Gen'l. Chem. Div., Allied Chem. & Dye Corp. See adv't. Cover 3.

VALVES, safety relief, catalog 100; Manning, Maxwell & Moore, Inc. See adv't. p. 187.

VALVES, stainless steel, circular AD-2080; Crane Co. See adv't. p. 136.

VALVES, globe, angle, gate, catalog F-9; Henry Vogt Machine Co. See adv't. p. 44.

VAPOR RECOVERY unit for loading standpipes and hoses, information; Vernon Tool Co., Ltd. See adv't. p. 169.

WATER COLUMNS and gages, catalog; Ernst Water Column & Gage Co. See adv't. p. 155.

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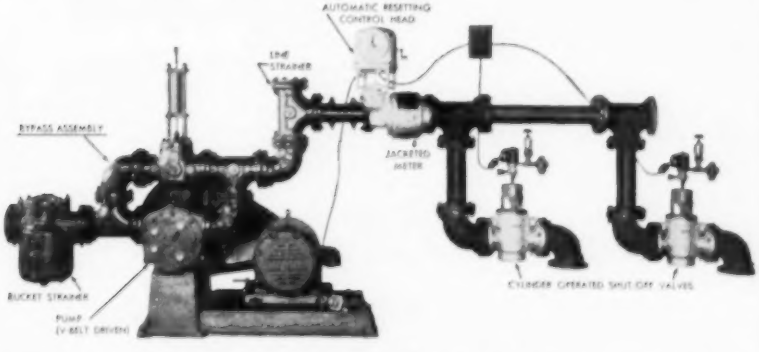

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for a more flexible production schedule

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Circle the code letter on the "Advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

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ADVERTISERS' INDEX

A

Air Preheater Corp. (H-2) 148
Airetool Mfg. Co. (H-6) 156
Alloy Steel Products Co., Inc. (C-7) 39
American Cyanamid Co., Refinery Chem. Dept. (D-4) 45
Annin Co. (J-5) 165

B

Babcock & Wilcox Co. (C-3) 33
Baker-Raulang Co. (C-8) 40
Bakelite Co., Union Carbide & Carbon Corp. (F-7) 102
Barnes Engineering Co. (J-3) 164
Beckman Instruments, Inc., Data Processing (D-9) 51
Beckman Instruments, Inc. Process Instruments (G-8) 145
Betz, W. H. & L. D. (H-4) 154
Bingham Pump Co. (E-8) 61
Black, Sivalls & Bryson, Inc. (J-9) 170
Bridgeport Brass Co. (M-2) 199
Brooks Rotameter Co. (K-9) 188
Brown Fintube Co. (E-4) 55
Burrell Corp (M-7) 206

C

Carrier Corp. (F-3) 67
Chicago Bridge & Iron Co. (D-5) 46
Cities Service Oil Co. (B-5) 21
Colton Chemical Co. (B-3) 20
Condenser Service & Engr. Co. (L-4) 192
Cooper Alloy Corp. (K-7) 186
Crane Co. (G-4) 136
Crawford Fitting Co. (K-4) 177

D

DeZurik Shower Co. (H-8) 160
Dow Chemical Co. (E-1) 52
Dowell, Inc. (C-1) 31
DuPont de Nemours & Co., Inc., Petroleum Chemicals Div. (D-8) 49-50
DuPont de Nemours & Co., Inc., Petroleum Chemicals Div. (H-7) 158
DuPont de Nemours & Co., Inc. Finishes Div. (B-4) 22

E

Enjay Co. (L-1) 189
Ernst Water Column & Gage Co. (H-5) 155
Ethyl Corp. (A-3) 4-5

F

Fischer & Porter Co. (M-1) 198
Foster Wheeler Corp. (E-5) 56-57
Foxboro Co. (B-7) 26-27
Frangible Discs, Inc. (K-3) 177

G

Gas Atmospheres, Inc. (M-9) 208
Gen'l. American Trans. Corp., Plate & Welding Div. (F-5) 98-99
Gen'l. American Trans. Corp., Terminals Div. (A-5) 8
Gen'l. Chemical Div., Allied Chem. & Dye Corp. (N-2) Cover 3
General Electric Co. (C-5) 36-37
Gordon Co., Claud S. (J-2) 163
Graver Tank & Mfg. Co. (F-8) 127-130
Gustin-Bacon Mfg. Co. (E-9) 62

H

Hammond Iron Works (B-6) 23-25
Harshaw Chemical Co. (A-2) 1
Hercules Powder Co. (A-6) 11
Hetherington & Berner, Inc. (K-2) 177
Houdry Process Corp. (M-5) 203
Hudson Engineering Corp. (A-1) Cover 2

I

International Business Mach. Corp. (B-1) 18
International Nickel Co. (G-5) 141

J

Johns-Manville Corp. (M-8) 207
Johnston & Jennings Co. (A-19) 17

K

Kellogg Co., M. W. (N-1) 209

L

Lindberg Engineering Co. (L-6) 194
Lukens Steel Co. (D-1) 42
Lummus Co. (A-7) 13

M

Manning, Maxwell & Moore, Inc. (K-8) 187
McKee Co., Arthur G. (D-7) 48
Metal Textile Corp. (K-6) 185
Mexico Refractories Co. (H-1) 147
Midvale-Heppenstall Co. (E-3) 54
Mixing Equipment Co. (F-4) 68
Monsanto Chemical Co. (B-2) 19
Moore & Co., Samuel (C-9) 41

N

National Airoil Burner Co. (G-7) 144
National Aluminate Corp. (A-4) 6
Newport News Shipbuilding & Drydock Co. (F-1) 63
Niagara Blower Co. (L-8) 196
Nicholson & Co., W. H. (C-2) 32
Nitrogen Div., Allied Chem. & Dye Corp. (G-3) 134
Norton Co. (L-9) 197

O

Oakite Products, Inc. (M-4) 202
Oil Statistics, Inc. (J-6) 166
Olin-Mathieson Chemical Corp. (L-7) 195
Oronite Chemical Co. (G-2) 133
Owens-Corning Fiberglas Corp. (E-2) 53

P

Patent Scaffolding Co., Inc. (K-5) 183
Patterson Foundry & Mach. Co. (G-9) 146
Petreco (H-9) 161
Petro-Chem Development Co., Inc. (G-6) 142
Pfaudler Co. (F-9) 131
Phelps Dodge Refining Corp. (L-2) 190
Phoenix Mfg. Co. (J-7) 169
Powell Co., William (G-1) 132

Q

Quaker Oats Co. (C-6) 38

R

Refinery Engineering Co. (D-2) 43
Rhodia, Inc., Alamask Div. (M-3) 200
Ridge Tool Co. (K-1) 172
Rockwell-Nordstrom Valves (B-9) 29-30

S

Selas Corp. of America (D-6) 47
Shand & Jurs Co. (A-8) 14
Solar Aircraft Co. (E-6) 58
Stauffer Chemical Corp. (B-8) 28

T

Tretolite (J-1) 162

U

U. S. Gasket-Belmont Packing (M-6) 204
U. S. Steel Corp. (L-3) 191
Universal Oil Products Co. (C-4) 34-35

V

Vernon Tool Co., Ltd. (J-8) 169
Vogt Machine Co., Henry (D-3) 44

W

Warren Petroleum Corp. (F-2) 64
Washington Aluminum Co., Inc. (J-4) 165
Wolfe Co., Franklin C. (H-3) 150
Wolverine Tube, Div. Calumet & Hecla, Inc. (E-7) 59-60
Worthington Corp. (F-6) 100-101
Wyatt Metal & oiler Works (N-3) Cover 4

Z

Zallea Brothers (L-5) 193

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 168
EQUIPMENT (Used or Surplus New) For Sale 168

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21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

(B) ADVERTISED PRODUCTS *See Index on facing page*

A1	B1	C1	D1	E1	F1	G1	H1	J1	K1	L1	M1	N1	O1	P1	Q1	S1	T1	U1	V1
A2	B2	C2	D2	E2	F2	G2	H2	J2	K2	L2	M2	N2	O2	P2	Q2	S2	T2	U2	V2
A3	B3	C3	D3	E3	F3	G3	H3	J3	K3	L3	M3	N3	O3	P3	Q3	S3	T3	U3	V3
A4	B4	C4	D4	E4	F4	G4	H4	J4	K4	L4	M4	N4	O4	P4	Q4	S4	T4	U4	V4
A5	B5	C5	D5	E5	F5	G5	H5	J5	K5	L5	M5	N5	O5	P5	Q5	S5	T5	U5	V5
A6	B6	C6	D6	E6	F6	G6	H6	J6	K6	L6	M6	N6	O6	P6	Q6	S6	T6	U6	V6
A7	B7	C7	D7	E7	F7	G7	H7	J7	K7	L7	M7	N7	O7	P7	Q7	S7	T7	U7	V7
A8	B8	C8	D8	E8	F8	G8	H8	J8	K8	L8	M8	N8	O8	P8	Q8	S8	T8	U8	V8
A9	B9	C9	D9	E9	F9	G9	H9	J9	K9	L9	M9	N9	O9	P9	Q9	S9	T9	U9	V9

(C) REPRINTS AVAILABLE *See listing on next page*

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21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100

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A1	B1	C1	D1	E1	F1	G1	H1	J1	K1	L1	M1	N1	O1	P1	Q1	S1	T1	U1	V1
A2	B2	C2	D2	E2	F2	G2	H2	J2	K2	L2	M2	N2	O2	P2	Q2	S2	T2	U2	V2
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A4	B4	C4	D4	E4	F4	G4	H4	J4	K4	L4	M4	N4	O4	P4	Q4	S4	T4	U4	V4
A5	B5	C5	D5	E5	F5	G5	H5	J5	K5	L5	M5	N5	O5	P5	Q5	S5	T5	U5	V5
A6	B6	C6	D6	E6	F6	G6	H6	J6	K6	L6	M6	N6	O6	P6	Q6	S6	T6	U6	V6
A7	B7	C7	D7	E7	F7	G7	H7	J7	K7	L7	M7	N7	O7	P7	Q7	S7	T7	U7	V7
A8	B8	C8	D8	E8	F8	G8	H8	J8	K8	L8	M8	N8	O8	P8	Q8	S8	T8	U8	V8
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R2	R5	R8	R11	R14	R17	R20	R23	R26	R29	R32	R35	R38	R41	R44	R47
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- **Controlling Evaporation Losses**—Special Report on causes of storage evaporation in oil industry, and equipment and methods to combat these losses. 24 pages—$0.75; Circle **R20**

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WHAT'S NEW...

Clear Plastic Film . . .

. . . Can Package Almost Anything

A new plastic film, which has strength and resistance to oil and corrosive fluids, is now available for heat-seal packaging of almost any material. Its manufacturer claims it is possible to package most lubricating oil and oil based products, drugs and corrosive chemicals, as well as machine parts with critical surfaces.

The film is chemically inert and non-toxic, and is resistant to boiling and permeation of moisture and gas. It is heat sealable, with a bond stronger than the film, at 275 to 350°F. Tensile strength is greater than 15 lb per inch of width.

The film is available in widths up to 22 in. and is 4½ mil thick. The price is several times higher than cellophane and most other transparent films. **Minnesota Mining and Manufacturing Co.,** Dept. L6-106, St. Paul, Minn.

Circle No. **1** *on Reply Card*

Rust Removing Powder

. . . requires only one immersion to remove heavy rust, red oxide primer, baked lacquer and acid-proof paint.

This alkaline material, "Turco Alkaline Rust Remover," removes light rust in less than a minute. Heavy rust and multiple paint layers require greater immersion time. It contains no cyanide compounds nor does it emit corrosive fumes when used. No after-neutralization is required, only a pressure rinse.

Metals de-rusted with this material need no other treatment to prevent subsequent rusting than does any new metal. The cleansing action removes only the rust, it does not attack the metal surface as will an acid. The material is used at concentrations from 8 oz to 3 lb per gallon of water, and tank temperatures between 200°F and boiling. **Turco Products, Inc.,** 6135 So. Central Ave., Los Angeles 1, Calif.

Circle No. **2** *on Reply Card*

Remote Tank Gaging

. . . indicates the tank level in digital form on a supervisory control panel. Liquid levels are read to 64 ft in ⅛-in. increments.

The system will read or scan tank farms automatically, and can also be modified to determine and transmit average temperatures. Cyclic timers can be used to make readings at preselected times. A recorded reading can be fed into an electric typewriter or punch cards.

Liquid levels from tank farms of any size can be remotely measured over a single wire-pair of any length. The operator of the tank gage receiver selects the tank he wishes to measure and the selected tank immediately begins to transmit data. The tank number lights up on the left of the panel. Then, in the light register group to the right, a reading of liquid level in feet, inches and fractions of an inch appears.

The system can be set up to have remote receivers in several locations. **Bendix-Pacific Division,** 11600 Sherman Way, No. Hollywood, Calif.

Circle No. **3** *on Reply Card*

Miniature Transducer

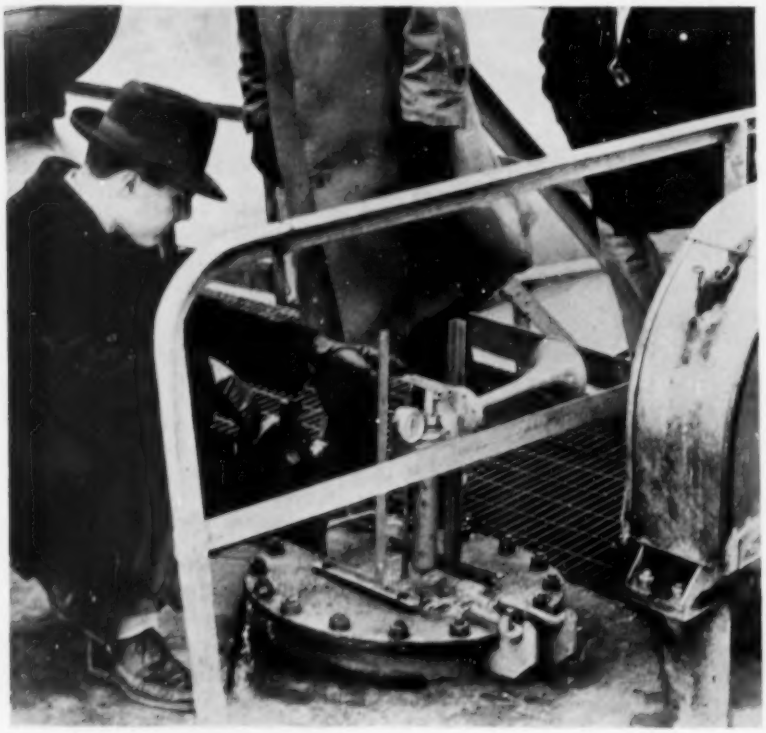
. . . changes pressures into voltage that can be read on a voltmeter, observed on an oscilliscope, or fed into a recording system.

Measuring only 1-in. in diameter, the small transducer can be mounted in pressure vessels and pipes without obstructing the flow or causing turbulence. Since there are no mechanical linkages, errors due to friction and wear are eliminated. A linear variable differential transformer acts as the sensing device, using frequency ranges from 2000 cps to above 10,000 cps.

Absolute pressure ranges are from 0-15 to 0-500 psia; differential pressure ranges from ± 0-15 to 0-500 psi; and gage pressure ranges from 0-15 to 0-500 psig. Proper selection of the excitation frequency permits operation at temperatures up to 450°F. **Schaevitz Engineering,** P. O. Box 505, Camden 1, N. J.

Circle No. **4** *on Reply Card*

(Continued on next page)



Self Powered Signal Horn . . .

. . . Prevents Tank Overflow

Powered by harmless carbon dioxide or other compressed gas, the Falcon tank-overflow horn can be heard more than 1,000 ft away. Activated by a float on the tank being pumped into, the horn sounds a sharp two to four-minute, or longer, warning to pumping crews.

When liquid level in the tank nears the safe filling limit, the float activates a mechanical linkage to the horn unit. The resulting signal is rated at 116 to 122 decibels, which is about 35 decibels louder than is required in approved fire alarm systems.

Special weatherproof cover assemblies shield the horn, toggle-spring valve assembly and pressure gage. The 2-in.-diameter steel cylinder that holds the compressed gas can be recharged from standard sources of CO_2, Freon 12, nitrogen or compressed air. Weight of horn, without float or cover assembly, is 14 lb. **Falcon Alarm Co.,** Inc., Summit, N.J.

Circle No. **5** *on Reply Card*

Radiation Meter

. . . **gives direct readings** of x-ray, gamma and beta radiations over a full scale, ranging from 3.0 to 3,000 milliroentgens per hour. The large meter face has a logarithmic scale which eliminates the need for switching scales in reading.

A unique one-tube circuit used in the Model 414 increases battery life and reduces operating cost to approximately 20¢ per 40 hours operation. Accuracy is ±20% throughout the entire range.

A built-in internal current source, used for calibration, eliminates the need for radioactive sources. The control switch may be switched to each battery source, and the strength of each is registered directly on the meter face. There is no need to open the instrument. Net weight is 5 lb. with the center of gravity located in the handle for easy holding. Over-all size is 9½-in. high, 12-in. long and 4⅛-in. wide. **Atomic Instrument Co.,** 84 Massachusetts Ave., Cambridge 39, Mass.

Circle No. **6** *on Reply Card*

Skid-Resistant Deck Paint

. . . **is spark proof,** and available in light gray or maroon colors.

After 15 months' testing, a slip-retardant paint for decks of tankers catwalks and oil loading platforms is available for distribution. Containing a relatively soft anti-slip agent, the paint may be applied by spray or brush. Unlike conventional slip-retardant paints, which usually employ hard, gritty agents that cause excessive wear on spray gun equipment. Being a non-metallic agent the new slip-retardant is also sparkproof. Two-coat application is recommended. **Finishes Division, E. I. du Pont de Nemours & Co.,** Wilmington, Del.

Circle No. **7** *on Reply Card*

Sprayable Plastic

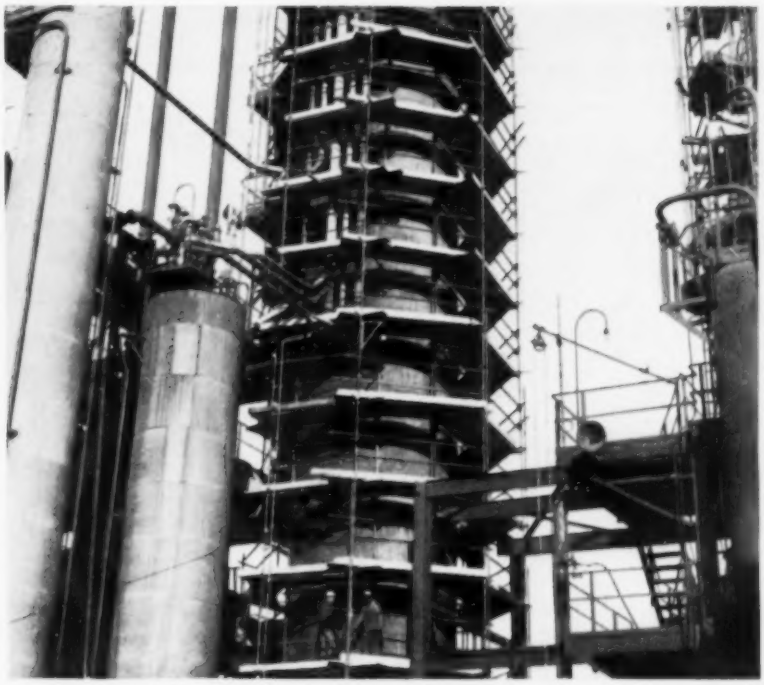
. . . **permits using ordinary metals** in place of costly alloys, when a film thickness of 50 to 60 mil is sprayed in one continuous layer on the metal.

A new formulation permits spraying in one coat "Unichrome Super 5300," a compound based on vinyl resins. It is resistant to strong acids, concentrated caustic and salt solutions, and other corrosive materials. The material forms a tough, flexible film which absorbs impact without chipping and withstands abrasion too.

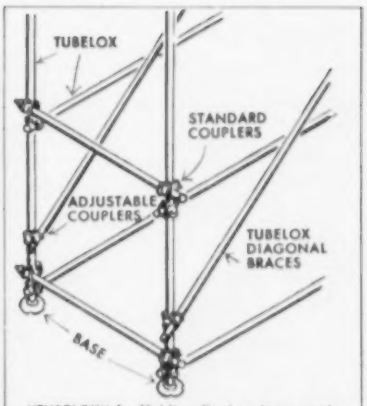
The one layer application from a spray gun gives "sheet" protection to tanks, ducts and other large equipment. There are no seams or joints where corrosives might penetrate. **Metal & Thermit Corp.,** Rahway, N. J.

Circle No. **8** *on Reply Card*

(Continued on page 184)



"TUBELOX" SCAFFOLDING assembles quickly for work on alkylation tower.



"TUBELOX" Scaffolding fits into bases and is erected quickly with standard and adjustable couplers for vertical, horizontal, and diagonal members. Any size, shape or height scaffold can be made with only four basic parts, all galvanized.

"TUBELOX" members 6' to 20' long, 2" and 2½" o.d., which interlock for continuous lengths.

STANDARD COUPLERS for right angle connections

ADJUSTABLE COUPLERS for diagonal connections

BASES to spread loads on first vertical members

Saving Turn-Around Time

How one large refinery does it with "TubeLox" Scaffolding

SAVING turn-around time for refinery maintenance and repair duty is an all-important factor. Many hours can be saved if scaffolding and work platforms are provided that can be erected, dismantled and moved with the utmost speed, efficiency and safety.

A large midwestern oil company uses "TubeLox"® Steel Scaffolding because it performs as required. It makes no difference what the turn-around jobs are—cracking, cooling or crude distillation towers; pressure vessels; heat exchangers; tanks, valves or piping—"TubeLox" Scaffolding works perfectly for all.

This versatile, all-purpose scaffolding, galvanized throughout to resist corrosion, is unlimited in its ability to conform to almost any shape, size or height encountered. There are virtually no obstructions which can not be overcome with "TubeLox" Scaffolding . . . even inside of tanks.

Towers and associated piping can be scaffolded with "TubeLox" Scaffolding to provide working platforms at any desired levels. It is fireproof and requires only a minimum amount of wood for staging. The strong, slender members offer little wind resistance and can be combined with "TubeLox" Aluminum End Frames, with built-in ladders, for extra light-weight, easily-handled rolling or stationary scaffolds of medium height.

Another important consideration given to "TubeLox" Scaffolding by this refinery is the fact that all components are 100% recoverable after each use and provide many years of practical, economical service.

"Trouble Saver"® Sectional Steel Scaffolding with standard frames varying from 3' high x 5' wide to 6'6" x 5', together with pivoted, diagonal braces, are often used for intermediate rolling or stationary platforms in refinery maintenance. "Gold Medal"® Midget and Junior Safety Swinging Scaffolds suspended by steel cables help in speeding the completion of light-duty repairs. The light-weight, ease-of-handling qualities of PS aluminum scaffolds save time and labor on many isolated turn-around jobs.

It would pay you to get the facts on how "TubeLox" and other PS Co. Scaffolding can help you save turn-around time. PS Co. offers complete nation-wide engineering service available locally. See the Yellow Pages in your telephone directory for the nearest Patent Scaffolding Co. office or representative that *sells* or *rents*" TubeLox" or "Gold Medal" Scaffolding.

For complete description and installation details . . . write for Bulletins PTS-18 and PTS-19.

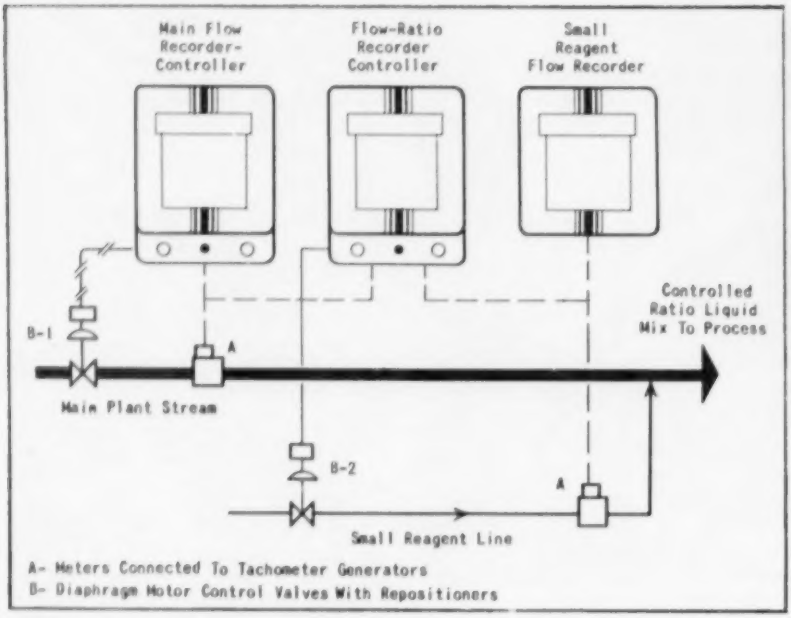
FOR GREATER SAFETY...EFFICIENCY...ECONOMY

GOLD MEDAL LADDERS SCAFFOLDING

THE PATENT SCAFFOLDING CO., Inc.

38-21 12th Street Dept. PP Long Island City 1, N. Y.
***West Coast:* 6931 Stanford Ave., Los Angeles 1, Calif.**
Branches in all principal cities
***In Canada:* 355 Dufferin St., Toronto**

(To obtain more data on advertised products see page 178)



Flow Proportioning System . . .

. . . Holds Blending Ratio to 0.5%

Designed to meet specifications of a large chemical company, this flow-ratio control system meters the flow of two process streams to a specified accuracy of 0.5%.

Permanent charts record both flow rates and the controlled ratio. In addition, a flow totalizer indicates the main stream flow in digital figures at a remotely located panelboard. A switch for diverting the mixed liquids to successive process vessels, after a preset quantity has been metered, is located on the panelboard too.

Primary elements for the two flows are Bowser piston-type, positive displacement meters with minor design changes to meet the high accuracy requirements. Each meter converts fluid flow into shaft rotation; the shaft in turn is geared to a tachometer generator. Thus, volumetric flow rate is translated into a proportionate analog voltage measured by a Leeds & Northrop Speedomax strip chart recorder.

The Speedomax instrument records and controls the flow-ratio. The desired process ratio is set by an adjustment knob on this controller and indicated by a pointer on its calibrated scale. A pneumatic control with proportional, reset, and rate time maintains the set ratio by positioning a diaphragm motor valve on the smaller reagent flow line. **Leeds & Northrop Co.,** 4970 Stenton Ave., Philadelphia 44, Pa.

Circle No. **9** *on Reply Card*

Tube Inspector

. . . **permits visual inspection** of the inside walls of cylinders, exchanger tubes, boilers and other hollow bodies.

Borescopes, as the units are named, range in size from ½ to 1¾-in. in diameter, and from 20 in. to 72 feet in length. Each instrument includes an illuminating system with a lamp in the objective viewing head. A current supply is attached to the eyepiece head by a short connector carrying circular contacts.

The optical system permits inspection of interior surfaces of fabricated assemblies, pipelines and other equipment without their disassembly. A variety of attachments permit forward, rear, lateral, oblique and wide angle views. The eyepiece may be rotated with a knurled ring for focusing. Photographs may be taken through special attachments. **Kollmorgen Optical Corp.,** 30 Church St., New York 7, N.Y.

Circle No. **10** *on Reply Card*

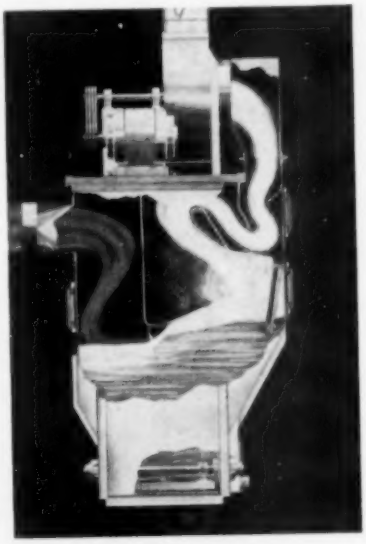
"Breeze Wagon"

. . . **quickly reduces temperature** in a large tank or confined area for emergency work.

This portable refrigeration unit can reduce temperatures as much as 30 to 40°, when using a cooling capacity of 60,000 Btu hr. The unit can pump 500 to 1,000 cu ft of refrigerated air per minute into a confined area.

Mounted on a four-wheeled steel cart with pneumatic tires, the unit can be moved from one plant location to another for speeding up maintenance work. **Peuchen Engineering Corp.,** P. O. Box 1969, Wilmington 99, Del.

Circle No. **11** *on Reply Card*



Wet Dust Collector

. . . **removes dust without mechanical means.** The operation is accomplished by different variations in pressure.

The dust laden air first enters the collector and expands at a reduced velocity. The heavier particles sink to

✔ Stop entrainment losses
✔ Improve product quality
✔ Cut process costs

with METEX Hi-Thruput MIST ELIMINATORS

Collection and recovery of valuable liquid products — removal of liquid particles harmful to subsequent processes — reduced equipment maintenance and decreased air pollution . . . these are but a few of the possibilities METEX Hi-Thruput Mist Eliminators offer to alert process and project engineers.

METEX Hi-Thruput Mist Eliminators, installed in a process tower or vessel, effect sharp separation of entrained liquids within a wide range of vapor velocities. Pressure drop is negligible. Quality and yield are increased. High removal efficiency is maintained, even at extreme temperatures, due to free-drainage of impinged liquids. Liquid slugs cannot enter turbines or compressors. Coke formation is minimized and life expectancy is substantially increased even under adverse conditions.

Where solids may be formed in the mesh because of decomposition, polymerization, crystallization or freezing, METEX Hi-Thruput Mist Eliminators provide up to three times the service life of conventional units.

In any processing equipment or vessel where liquid entrainment is a contributing factor in design or operation, METEX Hi-Thruput Mist Eliminators assure higher production, better processing and lower operating and maintenance costs.

For complete information and specifications, write today for your copy of Bulletin ME-106, illustrating and describing METEX Mist Eliminators for all process equipment.

METEX QUALITY PRODUCTS
6-075

METAL TEXTILE CORPORATION
ROSELLE, NEW JERSEY

METAL TEXTILE CORP. OF CANADA, LTD., HAMILTON, ONTARIO
Representatives in principal cities throughout the world

• Edited by GEORGE BLACK

DOUBLE-D REFINER

The Jones Double-D Refiner is said to bring an entirely new concept to the preparation of stock for the paper machine. Key to the design lies in the twin refining area with its double discs. For a more complete story ask for the February issue of Cooper Alloy NEWSCAST.

WHAT'S IN A TRADEMARK

Behind the Cooper Alloy trademark, cast or stamped into our stainless steel fittings, stands more than a quarter century of experience and the most complete production facilities in the industry. When you specify Cooper Alloy fittings you can be sure that every step from design to shipment is under the supervision of specialists. Look for the CA trademark before you buy . . . it is a sign of quality, experience and reliability.

DESIGN FEATURES FEATURED

Design features that have made the Cooper Alloy stainless steel valve the preferred valve for chemical processing are presented in the current issue of NEWSCAST. Diagrams and text combine to make a thorough presentation. Additional copies available on request.

NEW PUMP IN DEMAND

The new line of stainless steel rotary pumps announced by our Vanton Pump Division has taken the field by storm because it is the one (and only) pump of its kind without stuffing boxes or shaft seals. Bulletin VP561 gives the facts. Write for it today.

COOPER ALLOY
CORPORATION • HILLSIDE, N.J.

the bottom of the tank as a sludge. The air with the lighter particles still remaining is sucked through one or more venturi tubes into a discharge chamber.

The low pressure area in the venturi throat induces the lighter particles to go along with the high velocity air stream. As the water and air mix, the dust particles are transferred to the water. As the air, water and sludge mixture impinges on special surface plates in the discharge chamber, the sludge settles to the bottom. The washed air then has the droplets of water removed in an eliminator.

The "Ventrijet" is available in sizes ranging from 1,000 to 30,000 cu ft/min, in both single and double row types. **Pangborn Corp.,** Hagerstown, Md.

Circle No. **12** *on Reply Card*

New Elevator

. . . carries free flowing materials to almost any height within 4-, 8- or 12-in. tubes.

Containing few parts, the unit consists of a standard steel cable carrying concave stamped or cast metal buckets or fastenings to wear out. The under compression. There are no rivets or fastenings to wear out. The cable flexes naturally under low stress. A simple take-up screw adjusts for cable stretch.

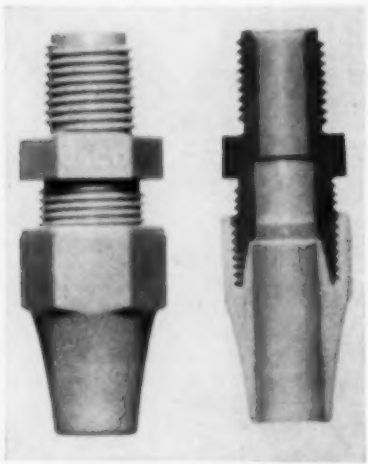
Sprockets are eliminated by the use of pneumatic, rubber-tired drive and take-up wheels. Both the cable and the tubes are built in standard section lengths, and the elevator can be assembled to almost any practical height. Either center-discharge chute for low speed of 60 fpm, or a side-discharge chute for high speed operation up to 250 fpm is available. **Hapman Conveyors, Inc.,** Kalamazoo, Mich.

Circle No. **13** *on Reply Card*

Internal Caliper

. . . for direct readings of tubes and tube holes in tube sheets. The caliper is spring loaded for greatest accuracy and graduated in 0.001-in. The instrument comes complete, ready for use, and can be obtained in calibration ranges of 0.400 to 0.800-in., 0.800 to 1.200-in., 1.200 to 1.600-in., and 1.600 to 2.000-in. **Airetool Mfg. Co.,** 328 Center St., Springfield, Ohio.

Circle No. **14** *on Reply Card*



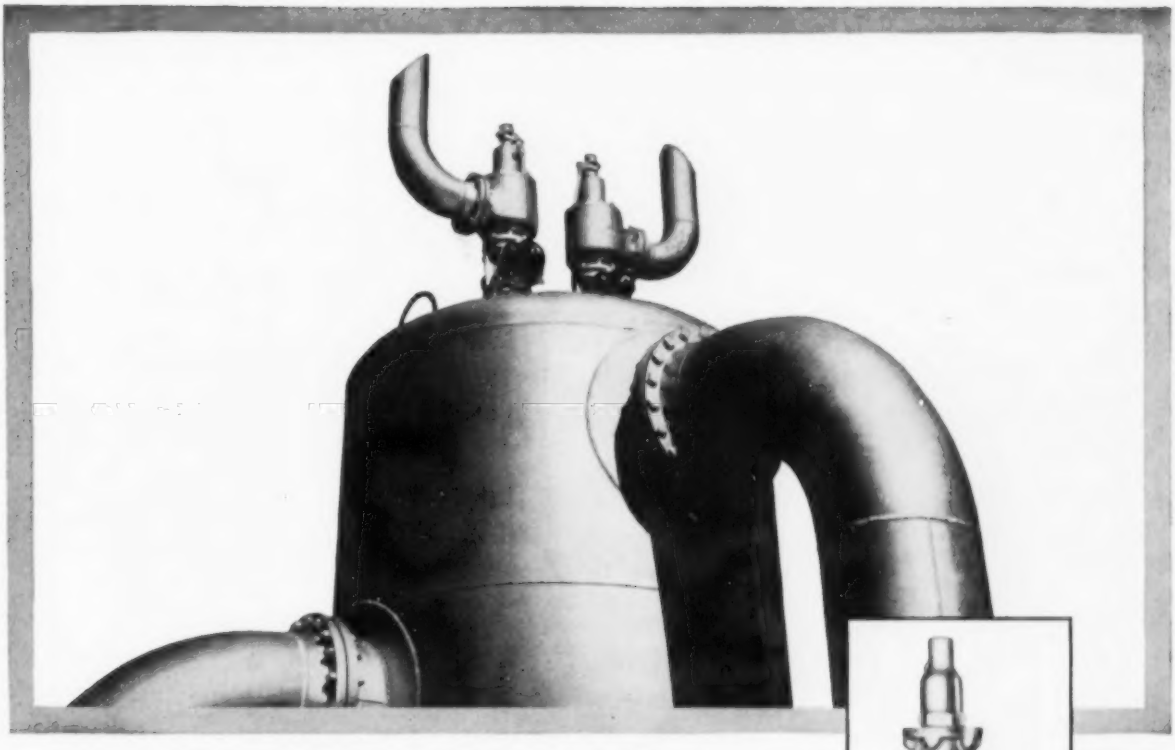
Nylon Fittings

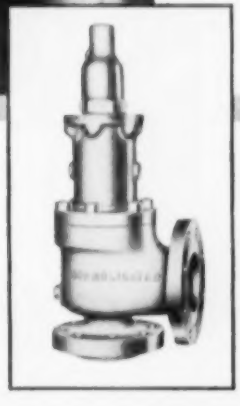
. . . for plastic or metal tubing permits joining brass, aluminum, copper, and steel without galvanic action.

Made in two pieces from molded nylon, the flareless fittings can provide a leak proof seal up to 500 psi. They are unaffected by petroleum oils and greases at temperatures up to 300°F, but should not be used above 275°F under load conditions. Units are available in a complete line of shapes and sizes, from ⅛ to ½-in. tube and pipe sizes. **Thomas Associates,** 4607 Alger St., Los Angeles 39, Calif.

Circle No. **15** *on Reply Card*

(Continued on page 188)





★ Economical "2 in 1" Design
★ Peak Performance
★ Absolute Protection
★ Maximum Interchangeability

CONSOLIDATED SAFETY RELIEF VALVES GIVE YOU ALL FOUR—AND MORE

Consolidated Safety Relief Valves satisfy *every* requirement of the most advanced processing facilities. Valve action is *consistently* positive. You get peak performance even where discharge lines are long or there is low "superimposed" back pressure in the relieving system!

The Standard type can be converted to Bellows type *in the field*. Center-to-face dimensions of inlet and outlet are such that you can interchange these valves with the safety relief valves of other manufacturers. Real flexibility of application that cuts inventory costs! Optically-ground flat seating surface and fewer functional parts than comparable valves contribute greatly to easier, more economical maintenance.

Get top economy and absolute protection with Consolidated Safety Relief Valves. Full range of sizes and pressures available. Write for Catalog 1900 for complete information.

CERTIFIED AND APPROVED. Both Standard and Bellows Valves are approved under API-ASME and ASME Unfired Pressure Vessel Codes and are certified by the National Board of Boiler and Pressure Vessel Inspectors.

In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

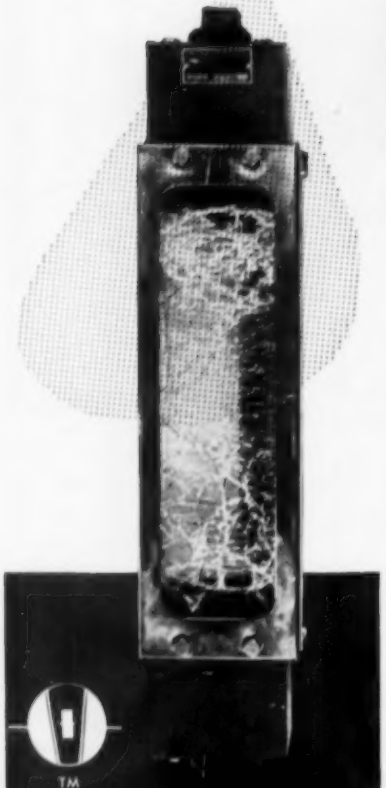
CONSOLIDATED SAFETY RELIEF VALVES

A product of **MANNING, MAXWELL & MOORE, INC.** TULSA, OKLAHOMA

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

BROOKS LEADERSHIP
achieved by design

Safe!



TM

A sudden line surge can pack a mighty wallop.

This Brooks* Full-View* Rotameter, rated at 200 psi, actually was subjected to a hydrostatic surge of well over 750 psi. The metering tube was smashed, slide-plates buckled, safety shielding shattered under the pressure.

But see how the safety shielding remained intact. Broken glass and spurting fluid were safely confined. Personnel were protected from possible serious injury.

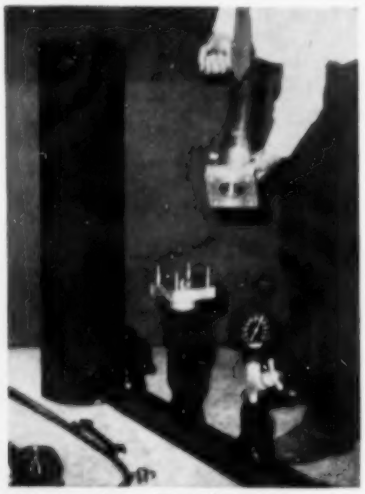
*Safety shielding is but one of many exclusive design features pioneered by Brooks . . . in the most practical rotameter available today.

For complete details, send for Bulletin 115.

*Trade-Names

A complete line . . . BROOKS . . . for every service
ROTAMETERS

BROOKS ROTAMETER COMPANY
107 EIGHTH STREET • LANSDALE, PA.

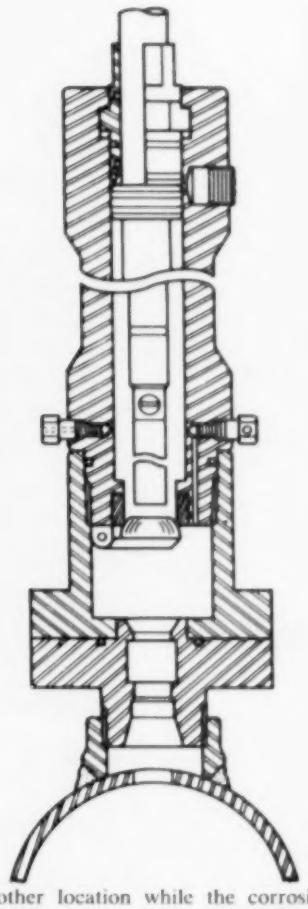


Corrosion Testing

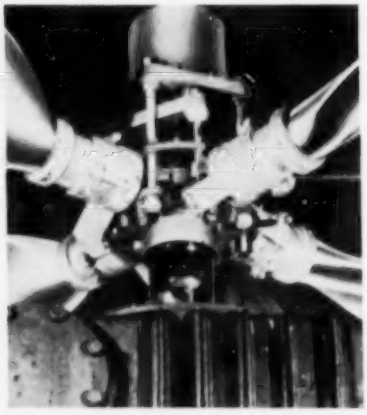
. . . **under high operating pressures** can be accomplished without shutting down operations or installing a special bypass line

A new tool, the Willis Corrosion Coupon Injector, hydraulically injects and withdraws metal samples into tanks, pipelines, vessels and columns which are under high pressure. The point of injection is a previously prepared half coupling or tee, drilled and welded onto the equipment to be tested. The base of the coupon injector is permanently screwed into the coupling.

A removable piston carries the sample in or out of the injection point. A clapper valve holds the high pressure while the piston assembly is removed. The insertion piston and cylinder may be removed for use at another location while the corrosion sample remains under test. **Willis Oil Tool Co.,** 3440 Pine Ave., Long Beach 7, Calif.



Circle No. **16** *on Reply Card*



Heat Exchanger Fan

. . . **has controllable pitch blades** for maintaining accurate fluid outlet temperatures.

On test installations the fans have held outlet temperature fluctuations to ± 1½ °F, when used with adequate temperature sensitive control systems. The fan assembly responds instantly to conventional control equipment, increasing blade pitch to deliver more air when the outlet temperature rises. When the outlet temperature falls, the blade pitch is decreased and less air is delivered.

The design of the controllable pitch fan is based on the same principle used on full feathering props for light twin-engine airplanes. In fact, many of the same parts are used such as the ball-bearing and clamp blade retention mechanism, and the heavy torque tube which will withstand the heavy loads of a heat exchanger installation.

The controllable pitch fan is designed to eliminate severe surges in the power line and expensive multiple-speed motor control devices. Power

to meet exacting lubrication standards, specify

ENJAY PARANOX®

detergent-inhibitor additives

When exacting lubrication standards must be met, you can depend on the Enjay Paranox group of highest-quality additives, famous around the world, for the right detergent-inhibitor to blend with every type of base stock.

Enjay has worked extensively with oil companies and leading engine manufacturers to develop lubricating oil additive formulations for military and commercial specifications.

Let us put this experience and know-how to work for *you*. Write, wire or phone the Enjay Company—your only source of a *complete* line of additives (Paramins®) for fuels and lubricants.

ENJAY

Pioneer in Petrochemicals

ENJAY COMPANY, INC., **15 WEST 51st STREET, NEW YORK 19, N. Y.** • Other offices: Akron, Boston, Chicago, Tulsa

load is at a maximum only when the fan is operating at maximum pitch. The pitch change technique is claimed sensitive enough to produce a minor blade pitch adjustment even when a cloud passes over the sun. **Hartzell Propeller Fan Co.**, Piqua, Ohio.

Circle No. **17** *on Reply Card*

Pipe Coupling

. . . **for asbestos-cement pipe** tightens itself as the pressure increases.

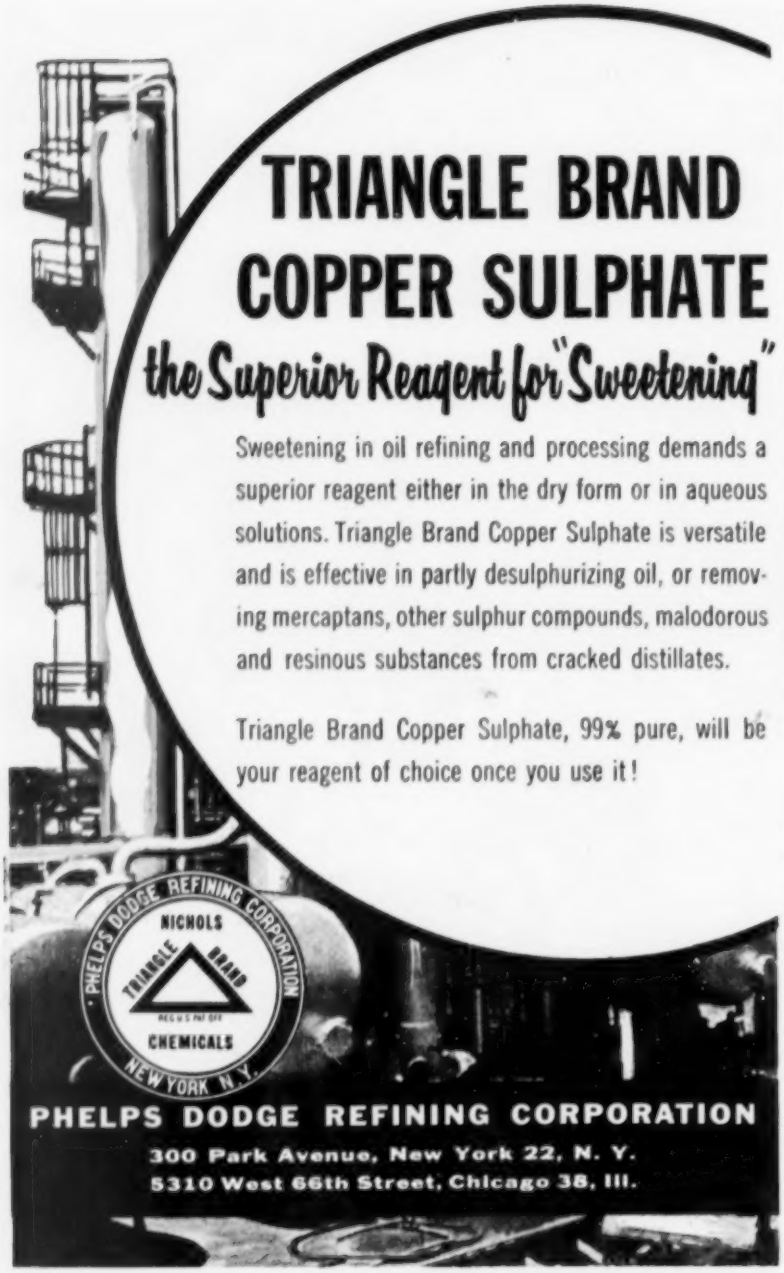
Use of a special folded rubber gasket permits the seal to expand as the internal pressure of the fluid carried by the pipe increases. The gasket swells and fits more tightly against both pipe and coupling, and leakage is minimized at higher pressures. The pipe can be coupled in wet ditches and other adverse conditions. Normal makeup is accomplished with a crowbar. **South Chester Tube Co.**, Finance Bldg., Philadelphia 2, Penn.

Circle No. **18** *on Reply Card*

Continuous Analyzer

. . . **for binary-liquid streams** determines the composition of two-component streams found in distillation, extraction, and washing and filtration. Concentration of both gases and solids in solution can be determined by refraction.

The Meeco-Matic Model II differential refractometer is designed for


TRIANGLE BRAND
COPPER SULPHATE
the Superior Reagent for "Sweetening"
Sweetening in oil refining and processing demands a superior reagent either in the dry form or in aqueous solutions. Triangle Brand Copper Sulphate is versatile and is effective in partly desulphurizing oil, or removing mercaptans, other sulphur compounds, malodorous and resinous substances from cracked distillates.
Triangle Brand Copper Sulphate, 99% pure, will be your reagent of choice once you use it!
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You can use the Reader's Service Card in this issue of PETROLEUM PROCESSING to order reprints. Here's how:

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- Circle the proper "R" letter on the Reader's Service Card (Area "C").
- Fill in your name and address—and send the card to us.

We'll bill you with the reprints

For ammonium sulfate production

–longer equipment life with Stainless Steel

Lion Oil Company, Chemical Division, El Dorado, Ark.

The big tank at this ammonium sulfate plant was originally made from carbon steel, lined with a non-ferrous metal. The lined vessel failed very quickly.

Then, type 316 ELC Stainless Steel was used to fabricate the tank, pipes, pumps *and* crystallizers. It was a wise investment, because the tank has been in continuous service for four years and remains in very good condition.

For chemical processing equipment, no other material combines the many desirable traits of Stainless Steel. When you need strength, temperature and corrosion resistance, along with a dense, smooth, easy-to-clean surface, always investigate Stainless Steel. And for service-tested quality, specify USS Stainless Steel.

UNITED STATES STEEL CORPORATION, PITTSBURGH · AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO · NATIONAL TUBE DIVISION, PITTSBURGH
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

SEE The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

USS STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS — USS — PIPE · TUBES · WIRE · SPECIAL SECTIONS

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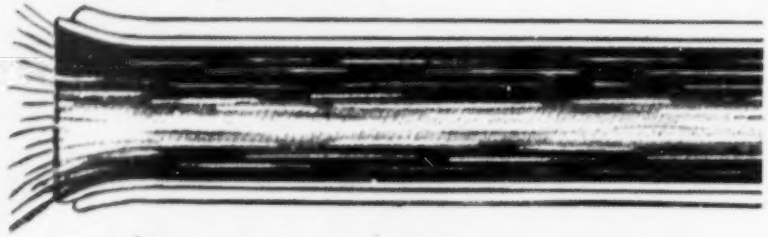
UNITED STATES STEEL

For this damaged tube...

THIS CURE



CONSECO FLOWRITES

INSURANCE AGAINST TUBE TROUBLE

Millions of times, in 25 years of service, under all conditions, FLOWRITES have proved they prevent tube end erosion. Conseco Flowrites are short molded nylon or metal tubes, inserted in the entrance end of condenser tubes. They are made of molded nylon or same metal as the tube itself. Eliminate gas and air pockets; prevent tube plugging; assure uninterrupted increased flow of water. Flowrites cost about 90% less than retubing; also prevent loss of revenue during plant shutdown. Flowrites are easy to install and repair, and are GUARANTEED. Write for special descriptive BULLETIN with M.I.T. Laboratory Report.

CONSECO UNIVERSAL GEAR BEVEL JOINTS

Solve shaft line-up problems; save on installation costs; reduce operating accidents. Positive transmission of torsion regardless of shaft angle, from 0° to 135° on vertical center line, or from 0° to 360° on horizontal center line. Capacity 1580 to 4938 inch pounds at 49 rpm.

Five standard sizes for shaft diameters of ½", ¾", 1", 1¼", and 1½". Special shaft lengths to order.

Other specialties include: *coils for feed water heaters and evaporators, Conco cleaning guns and plugs, condenser ferrules, detectaleak tube testers, fibre plugs, metallic and fibre packing for condensers, Wizard condenser injectors, etc.*

• WRITE US FOR SPECIAL BULLETINS •

CONSECO SERVICE

Conseco Service for repair or maintenance of any type or make of tubular equipment is at your service any day, any hour, Sundays, holidays, anywhere in the country. Just wire or 'phone our Service Department.

CONDENSER SERVICE & ENGINEERING CO., INC. (CONSECO)

Designers and Builders of Equipment for Power, Refining, Chemical and Marine Industries

54 BLOOMFIELD STREET
HOBOKEN, N. J.

plant operation and has a sensitivity 10 times higher than many laboratory type refractometers. The full-scale span of the instrument is adjustable from 10^{-1} to 4×10^{-4} refractive index units. The minimum detectable change in refractive index is 1% of full scale at any span.

Operating at its highest sensitivity, this differential refractometer can achieve the following full-scale spans:

Mixture	Full Scale, wt %
Acetic acid in H_2O	1.0
Acetone in H_2O	2.0
Ethanol in H_2O	1.5
Methanol in H_2O	20.0
Phenol in H_2O	2.5
Sulfuric acid in H_2O	0.5

The instrument has been developed by the DuPont Co. and is available from **Manufacturers Engineering & Equipment Corp.,** Hatboro, Penn.

Circle No. **19** *on Reply Card*

Fire Monitor

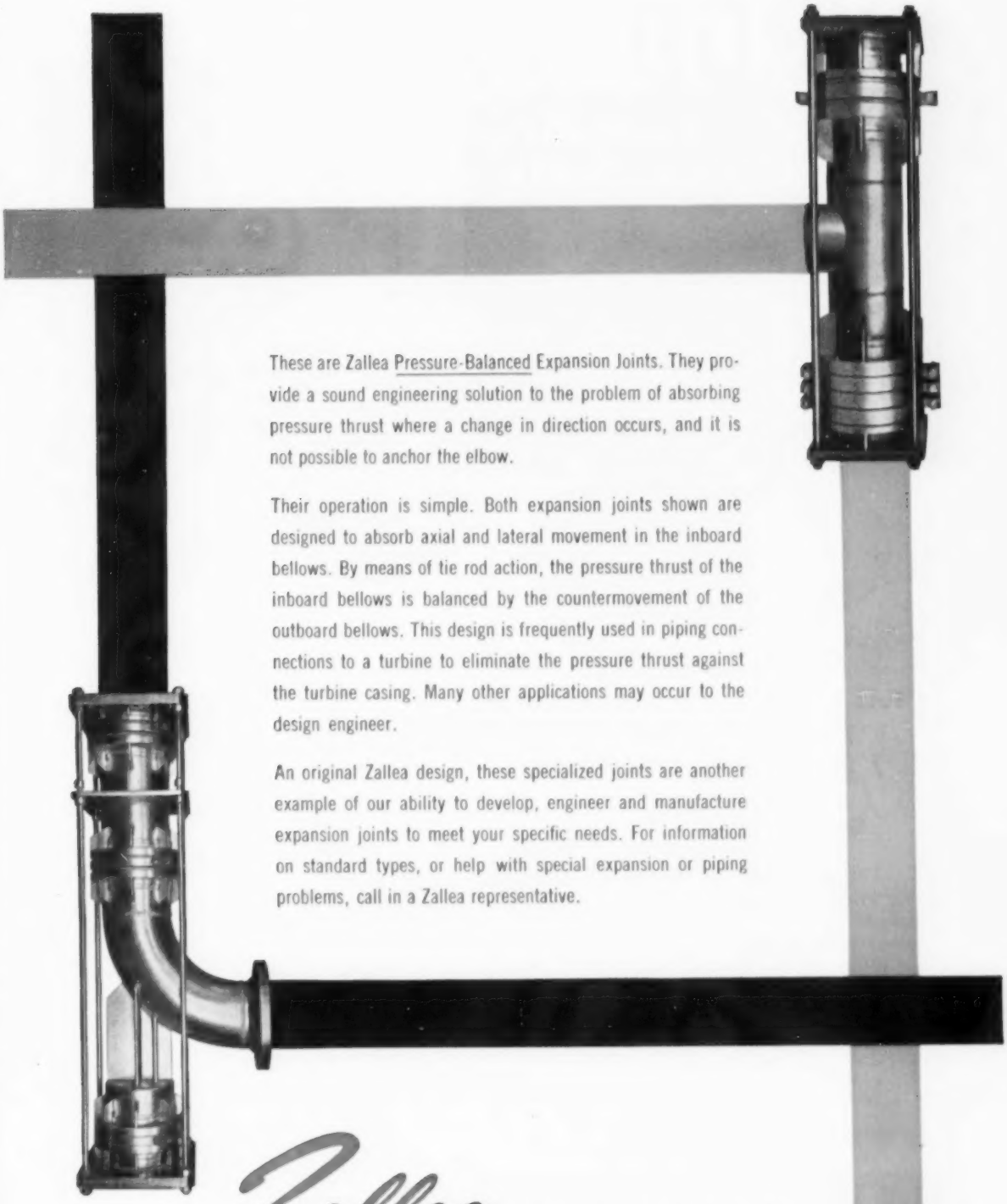
. . . **handles 2,000 gpm of water,** foam or chemicals at an effective striking range of 300 ft.

The device, known as the "Intelli-Giant", discharges a powerful stream of water through a 2½-in. tip. Hydraulic pistons, operated from diverted water pressure, swing the monitor in a horizontal travel pattern of 270° and a vertical swing of 120° in a matter of seconds. The valves and levers for hydraulic control can be mounted at a safe distance to permit remote operation.

The barrel of the monitor is fashioned so that the 270° turn in it balances the vector forces and minimizes the friction losses. This permits easy manual movement of the nozzle if the hydraulic controls are removed. The monitor may be mounted on any type of fire fighting vehicle, or it can be permanently stationed in a refinery area. **Chiksan Co.,** Brea, Calif.

Circle No. **20** *on Reply Card*

(Continued on page 194)



These are Zallea Pressure-Balanced Expansion Joints. They provide a sound engineering solution to the problem of absorbing pressure thrust where a change in direction occurs, and it is not possible to anchor the elbow.

Their operation is simple. Both expansion joints shown are designed to absorb axial and lateral movement in the inboard bellows. By means of tie rod action, the pressure thrust of the inboard bellows is balanced by the countermovement of the outboard bellows. This design is frequently used in piping connections to a turbine to eliminate the pressure thrust against the turbine casing. Many other applications may occur to the design engineer.

An original Zallea design, these specialized joints are another example of our ability to develop, engineer and manufacture expansion joints to meet your specific needs. For information on standard types, or help with special expansion or piping problems, call in a Zallea representative.

Zallea *expansion joints*

ZALLEA BROTHERS 822 LOCUST STREET, WILMINGTON 99, DELAWARE

World's Largest Manufacturers of Expansion Joints

PYRODISC

LINDBERG'S QUALITY PORTABLE HOT PLATE

✓ CAST-IN ELEMENTS
✓ FULL RANGE TEMPERATURE CONTROL
✓ PROTECTED TERMINALS
✓ STREAMLINED APPEARANCE

Only $27.50*

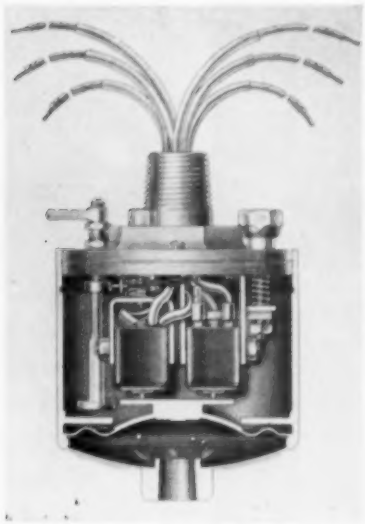
The Lindberg PYRODISC is especially designed to provide a dependable, quality-engineered hot plate at low cost. It is particularly practical for users whose hot plate needs are limited and do not justify the investment required for a higher capacity unit. PYRODISC is available from your laboratory supply dealer's stock.

Specifications: Diameter, top plate and base, 8 inches . . . Power rating, 660 watts . . . Power service, 115 volts, 50/60 cycle . . . Cord and plug included . . . Shipping weight, 10 lbs.

For additional information ask for Bulletin No. 1001 A.

*Price subject to change without notice.

LINDBERG
LABORATORY EQUIPMENT DIVISION
LINDBERG ENGINEERING COMPANY
2474 West Hubbard Street, Chicago 12, Illinois



Two-In-One Switch

. . . **signals when pressure rises** and falls, and also shuts down system if pressure continues beyond a safe limit.

Each of the switching elements can be electrically independent of the other, or two external leads can control a single circuit between maximum and minimum pressures. The manual reset is arranged so that the system cannot be reactivated until the pressure has returned to a safe level. The switch comes in three classes of pressures: 6, 30 and 120 psi, with an adjustable range from 0.05 to 100 psi. **Barksdale Valves,** Pressure Switch Div., 5125 Alcoa Ave., Los Angeles 58, Calif.

Circle No. **21** *on Reply Card*

Free Trade Literature

Minerals & Chemicals

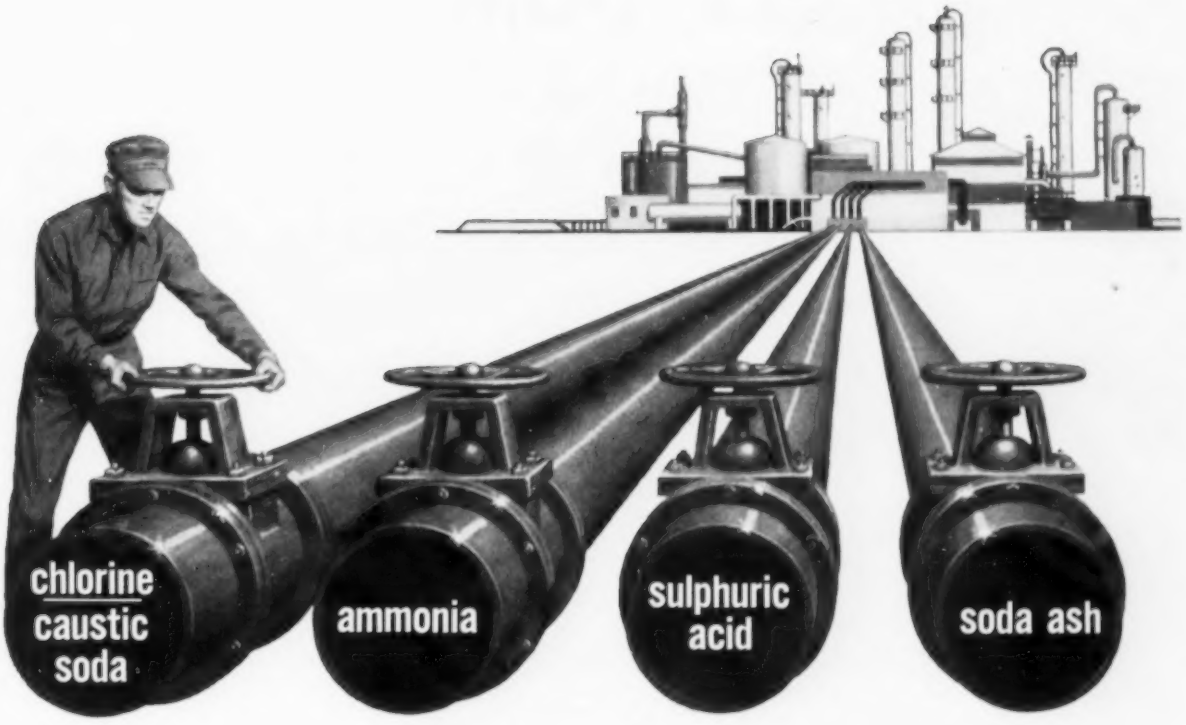
. . . the story of this company: a 16-page brochure explains the origin and formation of the company and describes the firm's operations in kaolin, Attapulgite, limestone and bauxite. Also included is a resume of the men who manage and direct the company, as well as a description of its new research facilities. Minerals & Chemicals Corporation of America, Menlo Park, N. J.

Circle No. **22** *on Reply Card*

Catalog

. . . of radioactive chemicals and related technical services: a 32-page booklet listing all of the isotopically labeled compounds and radio-active sources which are available from this nucleonic concern. Included in the 32

(To obtain more data on advertised products see page 178)



you can be on our "pipe line"

Want to smooth out your chemical supply problems? Tap into the Olin Mathieson "pipe lines." You'll see what our multi-plant production facilities can mean to you.

The effect of a number of producing points is to balance out local shortages and surpluses. In one instance, a serious chlorine shortage on the Gulf of Mexico was relieved by an excess in Canada. Each of the five plants between shipped into the next plant supply area to the South, setting up a chain reaction which released the needed tonnage on the Gulf.

Our combination of multi-plant facilities and an imaginative approach to the logistics of the chemical industry can prove invaluable to you. Discuss it now with an Olin Mathieson representative or write the Chemicals Executive Office in Baltimore.

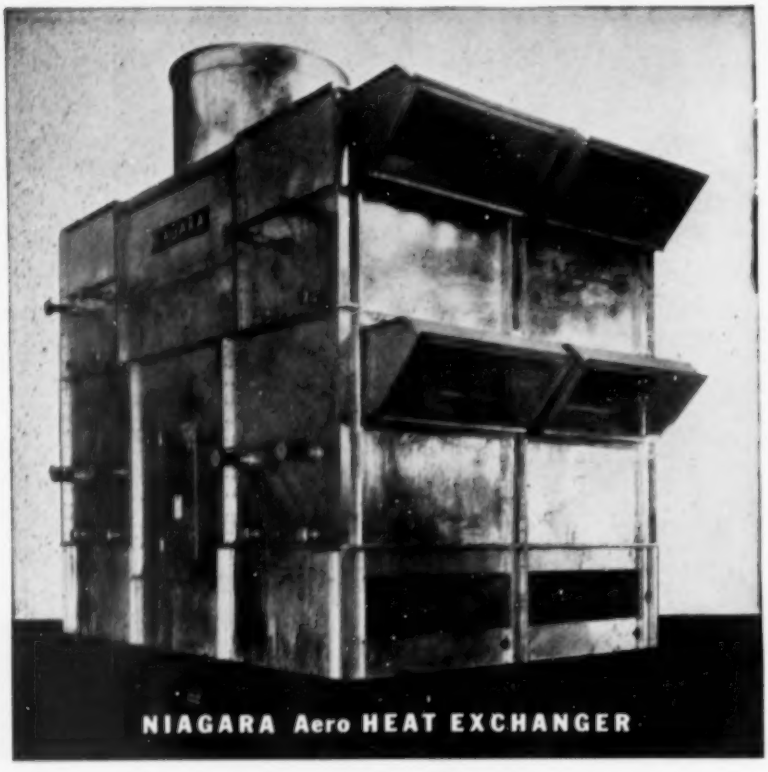
MATHIESON

MATHIESON CHEMICALS
OLIN MATHIESON CHEMICAL CORPORATION
INDUSTRIAL CHEMICALS DIVISION · BALTIMORE 3, MD

4128

INORGANIC CHEMICALS: Ammonia · Bicarbonate of Soda · Carbon Dioxide · Caustic Potash · Caustic Soda · Chlorine · Hydrazine and Derivatives · Hypochlorite Products · Muriatic Acid · Nitrate of Soda · Nitric Acid · Soda Ash · Sodium Chlorite Products · Sulphate of Alumina · Sulphur (Processed) · Sulphuric Acid
ORGANIC CHEMICALS: Ethylene Oxide · Ethylene Glycols · Polyethylene Glycols · Glycol Ether Solvents · Ethylene Dichloride · Dichloroethylether · Formaldehyde Methanol · Sodium Methylate · Hexamine · Ethylene Diamine · Polyamines · Ethanolamines · Trichlorobenzene · Polychlorobenzene · Trichlorophenol

Thirty Million B. T. U. CAPACITY



Cooling in Chemical Processes with Precise Control of Temperature

The NIAGARA Aero HEAT EXCHANGER cools liquids and gases by evaporative cooling with atmospheric air, removing the heat at the rate of input, controlling temperature precisely. You save 95% of cost of cooling water; you make great savings in pumping, piping, power; quickly recover your installation cost.

You can cool and hold accurately the temperature of all fluids, air and gases, water, oils, solutions, chemical intermediates, coolants for mechanical, electrical and thermal processes. You obtain closed system cooling free from dirt. You solve all the problems of water availability, quality or temperature.

In CHEMICAL PROCESSES this is successfully used in cooling liquids and gases, chemical reactions, condensing distillations and reflux cooling.

Write for complete information; ask for Bulletins 120 and 124. Address Dept. PP.

NIAGARA BLOWER COMPANY

405 Lexington Ave. New York 17, N. Y.

District Engineers in Principal Cities of United States and Canada

pages are useful tables on beta emitters, hard gamma emitters and available radioisotopes listed according to half-life. Technical Publications Dept., Tracerlab, Inc., 130 High St., Boston, Mass.

Circle No. **23** *on Reply Card*

Steam-Jet Coolers

. . in sizes from 30 to 1200 tons of refrigeration: *Form 9143-B* describes how to chill water temperature down to 35°F, using only water and steam, with no toxic refrigerant. Operating pressures are below atmospheric and there are no mechanical moving parts within the machine. An automatic controller for steam flow permits savings on amounts of steam used. Ingersoll-Rand, 11 Broadway, New York 4, N. Y.

Circle No. **24** *on Reply Card*

Flow Computer

. . . simplifies computations in the orifice measurement of fluids. The *Librascope Flow Computer* bulletin describes an instrument that extracts the square root and continuously integrates both differential and static pressures, without the use of cams or other intermittent devices. It provides an accurate and direct indication of flow, reducing or eliminating the need for charts conversion of flow readings. Librascope, 808 Western Ave., Glendale, Calif.

Circle No. **25** *on Reply Card*

Mechanical Drive Turbines

. . . for high speeds ranging up to 10,000 rpm and above: *Publication GEA-6232* describes the construction and design features of turbine drives for centrifugal compressors and blowers. Cross-section drawings explain the design of single-valve, single and multi-stage turbines, as well as multi-valve multi-stage and multi-valve single stage units for high back pressure applications. General Electric Co., Schenectady 5, N. Y.

Circle No. **26** *on Reply Card*

Infrared Spectroscopy

. . . a package of reprints on the subject: the *Infrared Package* contains a basic introductory article on this analytical tool, a chart summarizing the characteristic infrared absorption bands of specific groups from 4000 to 400 wave numbers, an article on hydrocarbon analysis by spectrophotometric instruments, and a complete index of available reprints on this subject. Scientific Instruments Division, Beckman

If your processing involves:

GRATES or SUSPENDING BEDS
PROTECTIVE ATMOSPHERES
DESSICANTS
MALEIC ANHYDRIDE
SYNTHETIC GAS GENERATION
NITRIC ACID MANUFACTURE
CATALYTIC REFORMING
ETHYLENE OXIDE
PHTHALIC ANHYDRIDE
DEHYDRATION
DEHYDROGENATION

You can benefit by using ALUNDUM* catalyst carriers

More and more chemical engineers are finding in Norton ALUNDUM catalyst carriers the R$_x$'s they need for faster, better, lower cost production in a wide range of processing.

These fused alumina carriers are characterized by excellent mechanical, thermal and chemical stability. They have high resistance to abrasion and erosion, and their low density is useful for packing and filling applications. Catalytically, they are crystalline in nature and are produced in two surface area types: low and intermediate. Intermediate surface area carriers are subdivided into types A, B, and C, with varying characteristics.

TYPICAL CHEMICAL ANALYSES (%'s)

	LOW SURFACE AREA	INTERMEDIATE SURFACE AREA
Al_2O_3	89.4–76.6	77.0
SiO_2	9.3–16.8	21.2
Fe_2O_3	0.5 – 1.3	0.2
MgO	0.1 – 0.6	0.4
CaO	0.1 – 0.8	
Na_2O	0.3 – 0.4	0.5
K_2O	0.1 – 1.0	0.2
TiO_2	0.2 – 2.5	0.5

PHYSICAL PROPERTIES

	Porosity	Water Absorption	Bulk Density	Vol. Bulk Density	Crystal Structure	Surface Area
Low Surface Area	40-50%	20-25%	1.90-2.10 gr/cc	65-80 lbs/ft³	Alpha Alumina	Less than 1m²/gram
Intermediate Surface Area Type A	50-55%	28-30%	1.65-1.70 gr/cc	58 lbs/ft³ (app)	Alpha, Gamma Alumina-chiefly Gamma	60-70m²/gram
Type B	50-55%	28-30%	1.65-1.70 gr/cc	60 lbs/ft³ (app)	Quartz, Alpha, Kappa, Delta Alumina-chiefly Quartz	20-30m²/gram
Type C	50-55%	28-30%	1.65-1.70 gr/cc	62 lbs/ft³ (app)	Alpha Alumina and Mullite	5-10m²/gram

Shapes and Sizes

Spheres: (Low surface area) 3/16"-1" diam; (Intermediate surface area) 1/4"-1/2" diam. *Pellets:* (All carriers) 1/8" x 1/8"-1/2" x 1/2". *Rings:* (All carriers) 1/8" x 1/4" x 3/8" O.D.-1" x 1 1/2" x 1 1/2" O.D.

Typical Applications

Low Surface Area Carriers: phthalic anhydride, maleic anhydride, ethylene oxide, protective atmospheres, synthetic gas generation, grates or suspending beds for active catalysts.

Intermediate Surface Area Carriers: catalytic reforming, dehydrogenation, dehydration, sulfuric acid manufacture, nitric acid manufacture, dessicants.

Get More Facts

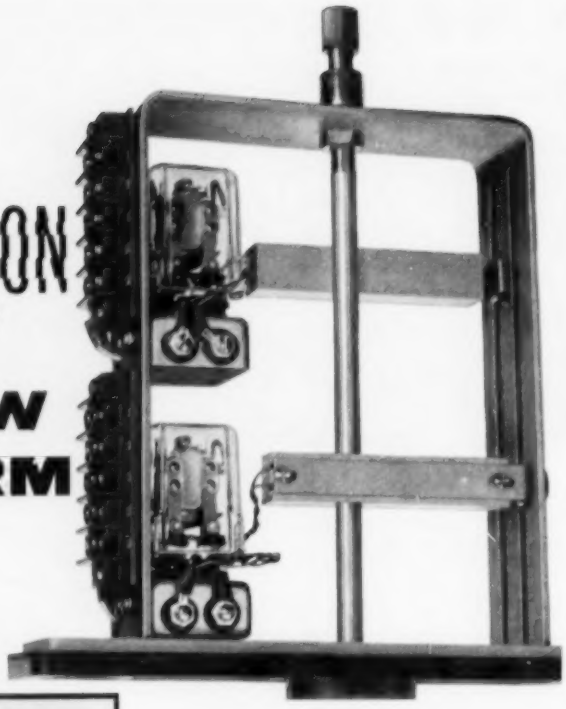
on how Norton ALUNDUM catalyst carriers are *engineered and prescribed* to give you the most effective combination of physical, thermal, chemical and electrical properties. Learn how they can improve and economize your processing. Call in your Norton Refractories Engineer, or write, mentioning your specific requirements, to NORTON COMPANY, 266 New Bond St., Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Canada.

NORTON
REFRACTORIES
Engineered... Rx... Prescribed
Making better products... to make your products better

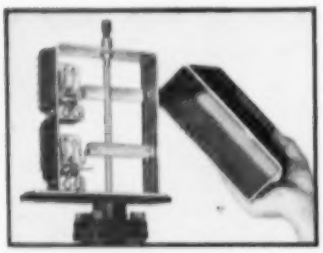
*Trade Mark Reg. U. S. Pat. Off. and Foreign Countries

(To obtain more data on advertised products see page 178)

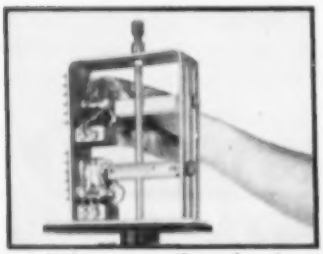
VIBRATION *proof* FLOW ALARM



Ratolarm with cover on



Ratolarm with cover removed



Relays are easily replaced

At last a low cost flow alarm immune to vibration. For linear scale flowmeters and liquid level applications.

Snap-action electrical contacts are hermetically sealed in glass. Contact closure can be made *only* by passage of the magnetic float extension rod. False alarms are eliminated.

Consider these advantages:

- Rugged, vibration-proof, glass-sealed switch
- High, low or double alarm, adjustable to any scale position
- Dependable, long life, low cost, no electronic parts
- Explosion-proof construction available
- Plastic enclosed plug-in relays for easy maintenance

Write today for complete information. Ask for catalog 10-A-84.

FP FISCHER & PORTER CO.

LA1086 | **3976 County Line Road, Hatboro, Penna.**

Instruments, Inc., 2500 Fullerton Road, Fullerton, Calif.

Circle No. **27** *on Reply Card*

Cranes and Derricks

. . . and how they are produced: in 40-pages. *Publication No. M-100* describes the types of cranes available, their uses and design details. Illustrated with pictures of the manufacturer's production shops, this catalog can serve as a good reference source for crane and derrick information. Dominion Bridge Co., Ltd., P. O. Box 280, LaChine, Quebec.

Circle No. **28** *on Reply Card*

Corrosion in Action

. . . a 48-page book taken from the film of the same title. This color-illustrated book describes the forces that cause corrosion, the origin of corrosion currents, and gives a list of experiments that illustrate these corrosive causes and forces. Requests for a copy should be addressed on company letterhead to Reader Service Section, International Nickel Co., 67 Wall St., New York 5, N. Y.

Do Not Use Reply Card

Engineering Services

. . . for the refinery, the chemical and petro-chemical industries. Well illustrated with photos, the 58-page brochure traces the history of this English design firm which has fabricating shops in Africa as well as the United Kingdom. Pictured are installation of refineries, petro-chemical plants, atomic installations and chemical plants. Matthew Hall & Co., Ltd., Matthew Hall House, Dorset Square, London, N. W. 1.

Circle No. **29** *on Reply Card*

Technical Data

. . . on Thermo-Panel coils, which are made of two sheets of metal with embossed channels welded together: *Bulletin 355* lists in 52 pages most of the engineering information needed for using these new pipe coils. Operating pressures, heat transfer coefficients, heating problems, walls and surface losses, conversion tables and material load are some of the subjects discussed in this handbook. Thermo-Panel Div., Dean Products, Inc., 616 Franklin Ave., Brooklyn 38, N. Y.

Circle No. **30** *on Reply Card*

Boiler Feedwater

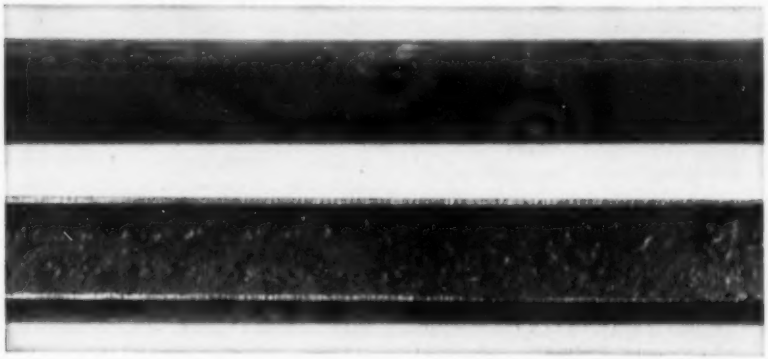
. . . and its treatment by demineralization: *Technical Reprint I-140* discusses in detail the advantages and

BRIDGEPORT BRASS COMPANY

CONDENSER AND HEAT EXCHANGER TUBE EDITION

COPPER ALLOY BULLETIN

Bridgeport Brass Co. MILLS IN BRIDGEPORT, CONN. AND INDIANAPOLIS, IND.—IN CANADA: NORANDA COPPER AND BRASS LIMITED, MONTREAL



Sections of low carbon steel condenser tube showing extensive effects of rust and corrosion on the water side in comparison to the unaffected surface of the ammonia side.

Duplex Tubes In Ammonia Condensers Can Cut Power Costs Up To 25%

The use of ammonia and other refrigerants in refrigeration systems has increased tremendously in recent years. Many problems—old and new—involving the handling of corrosive gases and liquids continue to crop up in domestic, industrial, processing, chemical and refining applications of refrigeration and air conditioning. It is important that we learn how to handle these corrosive gases and liquids.

In general, condenser tubes in refrigeration systems are subjected to dual corrosion; that is, one type of corrosive action inside the tube, an entirely different type on the exterior side. For this reason Bridgeport Duplex Tubes—with one metal inside and a different metal outside—are finding ever-wider application in the solution of these complex corrosion problems.

Ammonia Refrigeration

Although dry ammonia gas is not corrosive to many metals and alloys, it is not always used in the completely dry condition. When ammonia contains dissolved salts, water, air or other common contaminants, it severely attacks copper and copper-base alloys.

Steel, on the other hand, is very resistant to ammonia corrosion, and is widely used in equipment handling ammonia (both anhydrous and moist). However, low-carbon steel tubes have a major shortcoming that prevents their being the universal answer to ammonia refrigeration corrosion problems, namely; water corrosion.

Corrosion from the water or brine side has always been a problem with low-carbon steel tubes. While steel tubes are satisfactory in withstanding corrosion from the *ammonia* side, the water side rusts quickly . . . builds up a heat-insulating layer which must be removed from time to time at considerable cost.

This problem is now being overcome through the installation of Duplex Tubes composed of low-carbon steel to the ammonia side, and copper or copper-base alloys, on the water side. For circulating fresh water—Admiralty #30, Red Brass #85, or Copper are recommended. Where sea water is used for cooling, Aluminum Brass #54, Duronze IV #53 (Arsenical Aluminum Bronze) and Admiralty #30 are preferred because of their greater resistance to dezincification corrosion, and general corrosion by sea water. When velocity of sea water is comparatively high, greater resistance to impingement corrosion is given by Duronze IV #53 and Aluminum Brass #54.

With Freon and methyl chloride refrigerants in a dry condition, copper and copper-base alloys have proved very satisfactory for corrosion resistance and long tube life. Arsenical Admiralty #30 or Aluminum Brass #54 are recommended for installations using sea water as the coolant. Copper, Red Brass, Admiralty, etc. are popular for fresh-water installations.

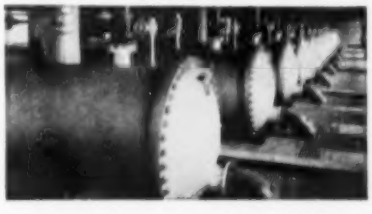
How Bridgeport Duplex Tubes Can Save You Money

Improved Heat Transfer. Mechanical bonding between the two components of Duplex Tubes is so tight that very satisfactory heat-transfer characteristics result. In addition, slime, algae and marine growths have less tendency to foul copper-base alloys than steel. Using copper or copper alloys on the water side therefore improves heat transfer because single-wall steel tubes pile up a thick insulating coat of rust which lowers heat-transfer value.

Reduced Maintenance, Shutdown Time and Labor. An ice company that replaced its steel tubes with Duplex (steel/Admiralty) reported two years later that four semi-annual cleanings were avoided . . . operating pressures are running 15 to 2 pounds lower . . . and that their Duplex Tubes have already paid for themselves.

Cut Power Costs! Replacement of corroded steel tubes in ammonia condensers has reduced power costs in some cases as much as 25%.

Greater Corrosion Resistance. Corrosion from water is often most severe at the inlet end of steel tubes, where turbulence is highest. Duplex Tubes will give greater corrosion resistance toward scale-forming waters which have been treated. And often in untreated raw waters—which would corrode low-carbon and stainless steels—Duplex Tubes can be used successfully.



Ammonia condensers equipped with Steel/Copper Duplex Tubes—Courtesy York Corporation.

More Than 100 Combinations

Bridgeport produces a wide variety of alloys, from which more than 100 Duplex Tube combinations can be manufactured. Specialists in our Corrosion Laboratory will gladly assist you in determining the condenser tube alloy that will give the best service in your specific application. Please write or phone your nearest Bridgeport Sales Office today for this expert assistance, and for delivery of Bridgeport high-quality copper alloys. (1198)

(To obtain more data on advertised products see page 178)

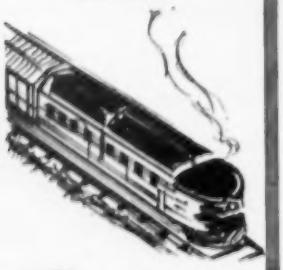
reodorize petroleum malodors with Alamask!

Make olfactorily acceptable petroleum products!

Producers of petroleum products and of petro-chemicals – by adding a selected ALAMASK reodorant – can improve odor characteristics of such materials. A specific ALAMASK is available to achieve adequate reodorization of a variety of petroleum products.

FOR REODORIZATION OF:

FUEL OILS *(regular or premium gasoline blends)*
KEROSENE
DIESEL OILS
CUTTING OILS and SPECIALTIES
many other petroleum products



Gain olfactory relief with an ALAMASK.

Write, wire or phone for specific information. Our Engineering Section provides complete technical guidance.

Rhodia INC.

60 East 56th Street, New York 22, N. Y.
Philadelphia • Cincinnati • Chicago • Los Angeles
Canada: Naugatuck, Montreal • Cuba: Luis Felipe, Havana • Mexico: Commerciale Reka, Mexico City

Need Engineers for Your Refinery . . . . Petrochemical Plant?

A quick solution to this problem can be obtained through an employment advertisement in our CLASSIFIED advertising section.

Petroleum Processing serves the refining and petrochemical industries and is the number 1 publication in readership, circulation, editorial service and advertising value.

Your employment advertisement will be read by just the type of men you need . . . Waste circulation is avoided.

Classified Advertising Division

PETROLEUM PROCESSING

330 West 42nd Street **New York 36, New York**

disadvantages of this process for today's power plants. New developments, trends and applications of both multi-bed and mixed-bed ion exchange are presented. This 24-page reprint also contains tables on characteristics of anion exchangers, materials of construction and specific conductivity of effluent. Graver Water Conditioning Co., 216 West 14th St., New York 11, N. Y.

Circle No. **31** *on Reply Card*

Thermocouple Data Book

. . . discusses construction and application of thermocouples and radiation detectors for industrial control: *Bulletin F-5228-3* includes information on how to check thermocouples, how to make them and how to select and size them. Included as part of this 40-page booklet are standard thermocouple temperature-millivolt equivalents, with temperatures expressed on the International Scale of 1948. Electromotive force is expressed in absolute units. Wheelco Instruments Div., Barber-Colman Co., Rockford, Ill.

Circle No. **32** *on Reply Card*

Steam Pumps

. . . their installation and care: *Booklet G-2280* contains information and photos taken from a sound slidefilm used for maintenance instruction courses. A step-by-step series of 88 illustrations tells how to increase the service life on all types of steam pumps. Worthington Corp., Harrison, N. J.

Circle No. **33** *on Reply Card*

Heat Exchangers

. . . for process industries: 18-page brochure, *Lummus Standard Heat Exchangers for Process Industries*, includes a description of the manufactured product as well as data required for its design. Tables of effective surface area, film co-efficients, pressure drops, fouling factors and tube characteristics necessary to solve basic heat transfer are presented. Lummus Heat Exchanger Div., 385 Madison Ave., New York 17, N. Y.

Circle No. **34** *on Reply Card*

Metered Pumping

. . . for flows from 11 cc/min to 6 gph: *Bulletin No. 300* describes the Hills-McCannameter, a type of packless positive displacement pump that meters liquids at pressures up to 2500 psi. The actual pumping element is a metallic bellows which is hermetically sealed. As hydraulic fluid is forced

Have You Checked Our Reprints Lately?

Are your data files complete? Here is a list of additional helpful reprints you may want, and which are available from PETROLEUM PROCESSING's Readers' Service Dept.

How to Order: Each reprint listed includes a code number as well as a price. Address your requests to:

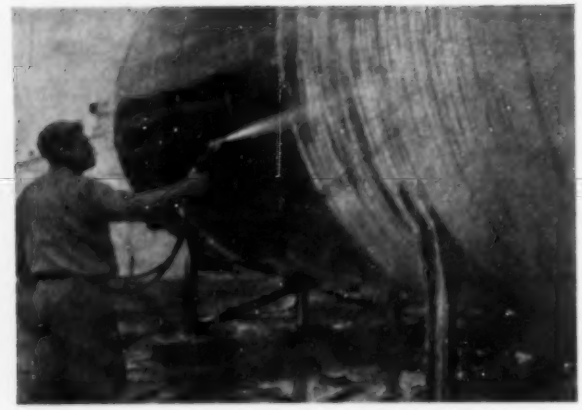
PETROLEUM PROCESSING
Readers' Service Dept.
330 West 42nd St.
New York 36, N. Y.

Or, if you prefer to use our handy Reader Reply Card, turn to p. 130 in this issue.

We'll fill your order right away, and send you a bill. Prices for quantity orders will be furnished on request.

- **Chemical Treating of Petroleum Fuels**—to remove and/or convert impurities. 24 pages—$0.75. Code **R12.**
- **The Heat Exchanger**—Special Report on process and mechanical design, costs, construction. 32 pages—$1.00. Code **R8.**
- **Catalytic Reforming Survey**—with trends, theory, and processing for catalytic reforming and aromatics recovery. 48 pages—$0.75. Code **R3.**
- **Vaporization Equilibrium Constant and Activity Coefficient Charts**—for conditions up to system critical point. 48 pages—$1.50. Code **R1.**
- **Clip-n-File Sheets**—$0.20 each, any 6 for $1.00. Process Data Sheets (PDS's) are three-page folders. Engineering Data Sheets (EDS's) are two pages on a special heavy paper for repeated handling and reference.

PDS No. 1, **Ethylene Oxide,** Code **R4**
PDS No. 2, **Butadiene-Butenes,** Code **R5**
PDS No. 3, **L'Azote Ammonia,** Code **R6**
PDS No. 4, **Ethylene-Kellogg,** Code **R9**
PDS No. 5, **Fluid Coking,** Code **R10**
PDS No. 6, **Urea Synthesis**—Chemico, Code **R16**
PDS No. 7, **Ethylene-Stone & Webster,** Code **R18**
PDS No. 8, **Thermofor Continuous Percolation,** Code **R21**
EDS No. 1, **Pressure Fundamentals,** Code **R7**
EDS No. 2, **Temperature Fundamentals,** Code **R11**
EDS No. 3, **Fluid Flow Fundamentals,** Code **R13**
EDS No. 4, **Flow Restrictions in Pipe,** Code **R14**
EDS No. 5, **Tank Capacities,** Code **R17**
EDS No. 6, **Heat—and Its Transfer,** Code **R19**
EDS No. 7, **Vapor Pressure,** Code **R22**



He's stripping a tank the Oakite way... fast, with no sand blasting!

Fast and easy – off comes the old paint from storage tanks under the action of powerful Oakite strippers.

Apply by hot or cold flow-on method, by steam-gun or brush. The Oakite stripper undercuts the paint, pries it loose ... and you simply wash it away. You get down to clean, bare metal – a perfect surface for priming and re-painting.

There's no hand scraping, chipping or sand-blasting, so you save time and money. You save, too, because long-life solution can be reclaimed and reused. And Oakite paint strippers, mixed with water, are safe. There's no fire hazard.

Your nearby Oakite Technical Service Representative will be glad to help you determine the Oakite stripper and method for best results at lowest cost. He has a great fund of experience on paint stripping ... and it's yours for the asking.

FREE. Oakite booklet F.7629, "How to Strip Paint". Write today for your free copy to Oakite Products, Inc., 50D Rector St., New York 6, N. Y.

Export Division
Cable Address: Oakite

OAKITE

Technical Service Representatives in Principal Cities of U. S. and Canada

into the bellows, the bellows distends and displaces a metered amount of the pumped liquid. Hills-McCanna Co., 3025 N. Western Ave., Chicago 18, Ill.

Circle No. **35** *on Reply Card*

3-Dimensional Engineering

. . . and design models for process plants: a brochure explaining the basic steps of engineering with a scale model, suitable for layout of piping, conduit, ducts and conveyors. Describes how the design, and resulting production drawings, can be started right on the model. Atkins & Merrill, Inc., South Sudbury, Mass.

Circle No. **36** *on Reply Card*

Dew Point Story

. . . in non-technical language explains terms such as relative humidity, saturation point, dew point and others. *The Dew Point Story* explains the operation of a typical plant compressed air system and why water vapor plays such an important part in its correct functioning. Available in quantity from Hankinson Corp., 260 Biltmore Bldg., Pittsburgh 16, Pa.

Circle No. **37** *on Reply Card*

Anhydrides

. . . are extremely reactive chemical intermediates: *Booklet F-5280* suggests uses and lists the physical properties, specifications and constant boiling mixtures of the anhydrides currently available. Principal compounds described are acetic, propionic and butyric anhydrides, which are finding new uses in regenerating acids, removing water in sulfonations and nitrations, and reaction with hydroxyl groups. Carbide and Carbon Chemicals Co., 30 East 42nd St., New York 17, N. Y.

Circle No. **38** *on Reply Card*

Inert Gas Generator

. . . for protection against fire and explosion: *Bulletin IGG-155* discusses the construction and operation of this equipment. In addition to detailed drawings, photographs, capacity and dimension tables, the booklet contains an analysis sheet for requesting further information. Roots-Connersville Blower Division, Connersville, Ind.

Circle No. **39** *on Reply Card*

Nickel Pressure Vessels

. . . meet the stringent operating requirements of many processes: *Bulletin No. 24*, "Nickel and High-Nickel Alloys for Pressure Vessels," is a 27-page technical report summarizing the

NOW AVAILABLE . . . a new, improved cracking catalyst

HOUDRY MINERAL KAOLIN

for TCC and Houdriflow Moving Bed Catalytic Cracking Units

Houdry Process Corporation now offers pelleted KAOLIN, a superior natural catalytic cracking catalyst, for maximum octane at lowest cost. The high octane gasoline obtained and the low catalyst make-up required assure top performance in all TCC and Houdriflow catalytic cracking units.

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. . . are made of a waxy, opaque, thermoplastic, tetrafluoroethylene resin with unusual properties. Described in *Form No. 6906* are the many gaskets, stuffing box packings, braided packings, and stem packings made from this material. "Teflon" shows no reaction to almost all chemicals—fluorine gas, chlorine trifluoride, and molten alkali metals being the exceptions. Raybestos-Manhattan, Inc., Packing Division, Passaic, N.J.

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. . . automatically plots titration curve: *Bulletin 640B* describes the plotting of a permanent record, which shows one, two, or three end points in one curve. The Recordomatic automatically controls the titrant feed rate throughout the entire range of 1.0 to 3.5 ml per minute. Its accuracy permits its use as a quality control instrument in the manufacture of standard solutions, too. Precision Scientific Co., 3737 W. Cortland St., Chicago 47, Ill.

Circle No. **42** *on Reply Card*

G-Fin Tubing

. . . and its many uses in heat exchanger construction: *Bulletin 1401* presents information about this patented finned tubing and its heat transfer advantages. Construction details of fittings, a table of dimensions of finned sections, descriptions of field installations, and some of the methods of section arrangement are covered in this bulletin. Griscom-Russell Co., Massillon, Ohio.

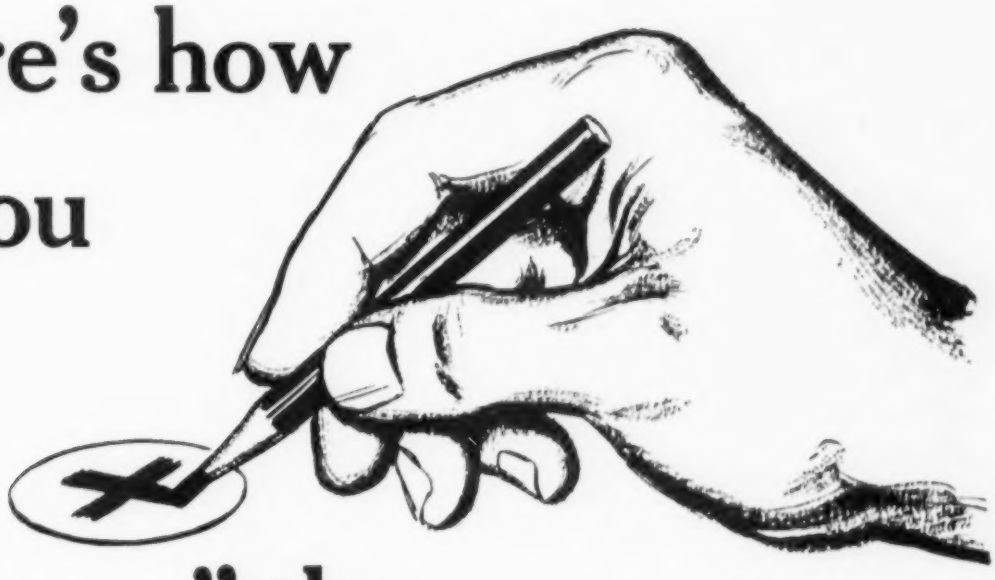
Circle No. **43** *on Reply Card*

Chromatography Catalog

. . . includes accessories for Electrophoresis, too: 36-page booklet, *Catalog No. C-465*, lists new apparatus developed for this method of separating the constituents of complex mixtures. Items cataloged include recent reference books, chemicals, glass equipment, drying ovens, ultra-violet lamps, and other accessories. Scientific Glass Apparatus Co., Inc., 100 Lakewood Terrace, Bloomfield, N.J.

(Continued on page 206)

here's how you "govern" the government



Much as we revere and respect this system of ours, we don't want the government running our lives.

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Did You Miss These?

The following items, reviewed originally in March, have aroused considerable interest among readers. They are repeated briefly here as a service to those who might have missed them the first time they appeared. For details or literature please use the regular Reply Card in this issue.

Saving Drafting Time

. . . is the topic of a booklet that compiles ways to use intermediates for drawing revisions: *11 Ways to Save Drafting Time* discusses specific ways that scissor editing, masking, the block-out method, successive additions, and pre-printing can reduce drafting time. Techniques discussed apply to various print-making methods including moist-developed ammonia, blueprint, sepia negative, and even reproduction cloth process. Frederick Post, 3666 N. Avondale Ave., Chicago, Ill.

Circle No. **45** *on Reply Card*

Drawing Templates

. . . for piping layouts simplify drafting room operations. Available as a matched set of five reversible templates, these drafting aids include all commonly used pipe and valve symbols needed for any piping layout. Available for ⅛, ¼, and ½-in. to-the-foot drawings, the templates cover symbols for all valves and special fittings used from ½ to 12-in. line sizes.

A complete kit consists of four fitting templates and one dimensioning template; the complete set is priced at $13.50. The larger templates sell individually for $3.50. All are made of rigid, non-glare vinyl. A. Lawrence Karp, 16 Putnam Park, Greenwich, Conn.

Circle No. **46** *on Reply Card*

Barometric Condensers

. . . their use, theory and types: *Bulletin 5AA* covers condenser theory and operation, a description of the parallel and countercurrent flow types, and information helpful in the selection of condensers under varying conditions. Schutte and Koerting Co., Cornwells Heights, Pa.

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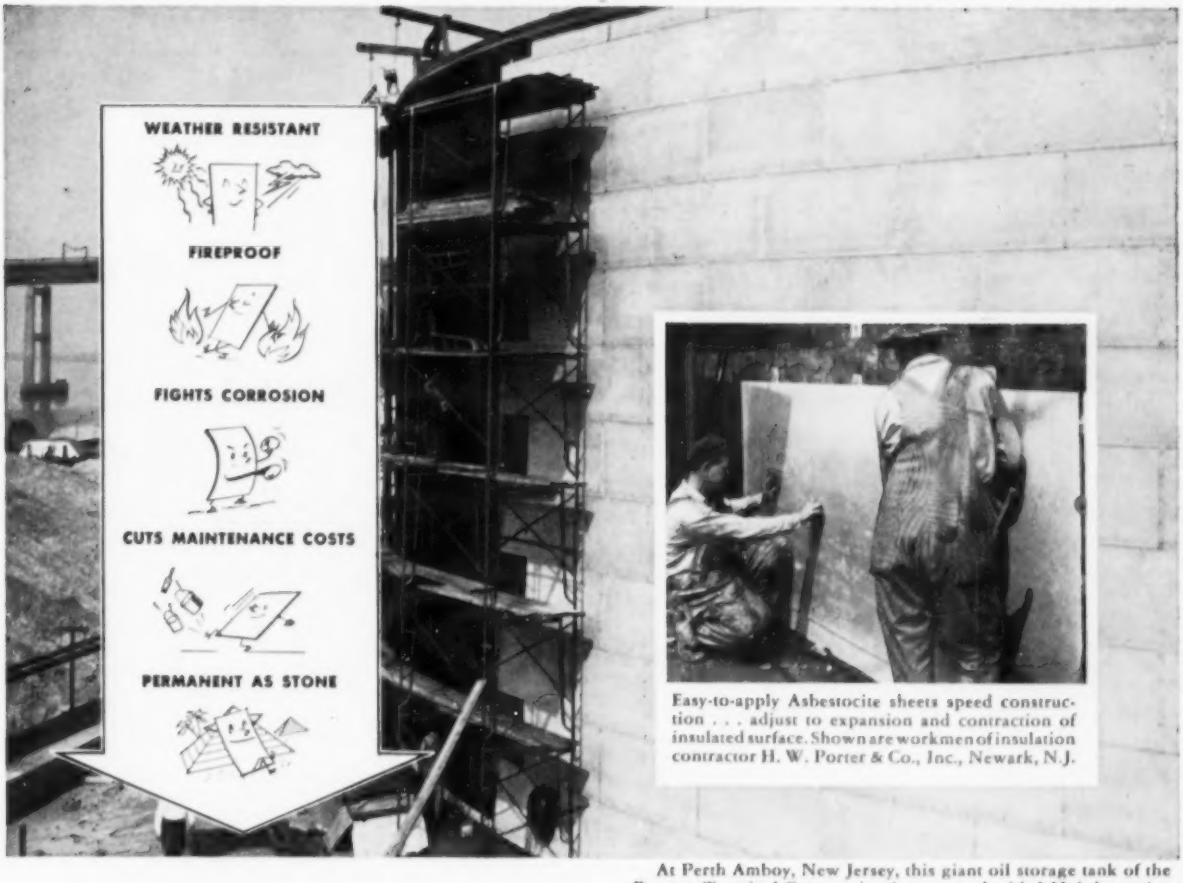
. . . reads to a maximum temperature of 1000°F, and is made of stainless steel. Within 60 seconds of placing the



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J-M Asbestocite is made of asbestos and cement combined under tremendous pressure into a uniform, monolithic sheet. Its stone-grey color provides a handsome appearance. Write for free brochures IN-121A and IN-173A. Address Johns-Manville, Box 60, New York 16, N. Y. In Canada, Port Credit, Ontario.

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(To obtain more data on advertised products see page 178)

instrument on the surface to be checked, the thermometer will read the temperature accurately to within ± 2%. It can be used on all surfaces such as heavy sheet metal, boilers, large steam pipes, and other surfaces within temperature ranges between 50 and 1000°F. Besides surface temperatures, it will read ambient temperatures in enclosed spaces as well as in non-corrosive liquids and gases. Its diameter is only 1¾ in., and the weight, ⅓ oz. Pacific Transducer Corp., 11836 W. Pico Blvd., Los Angeles 64, Calif.

Circle No. **48** *on Reply Card*

LP Gas Story

. . . a review of its amazing success and consumption: *LP Gas, The Cinderella Fuel,* is a brochure written for the layman. It tells the complete story of the gas, from its recovery from crude oil and natural gas to its many uses in the home. Gulf Oil Corp., Gulf Oil Bldg., Pittsburgh, Pa.

Circle No. **49** *on Reply Card*

Colored Slide Rule

. . . reduces eyestrain. The new light-alloy slide rule eliminates violet and red rays which focus in front of and behind the retina of the eye. The green-yellow shade is said to coincide with the optimum sight point of the spectrum, thus cutting eyestrain, blurring and errors in reading calibrations. The alloy slide rules will not corrode or bind. They are available in 6 and 10 in. trig. log-log, standard or special order types. Pickett & Eckel, Inc., 1109 S. Fremont Ave., Alhambra, Calif.

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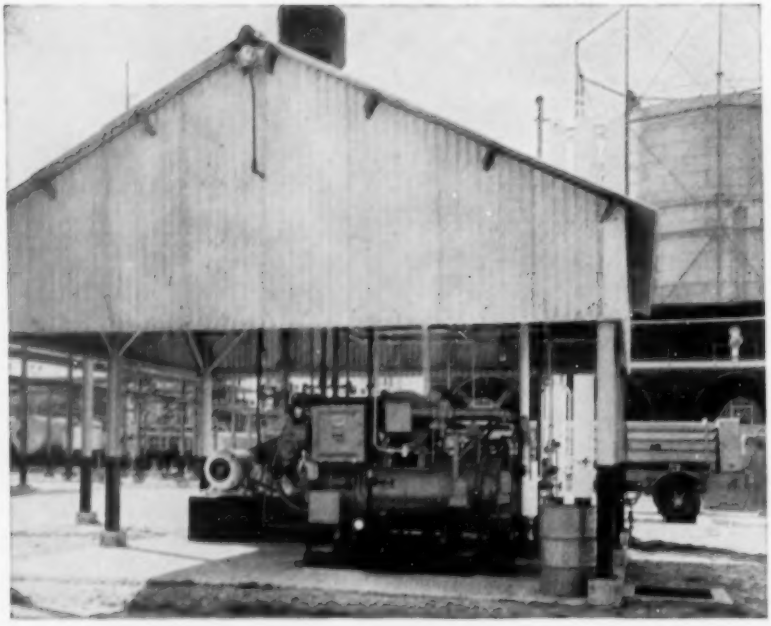
Circle No. **51** *on Reply Card*



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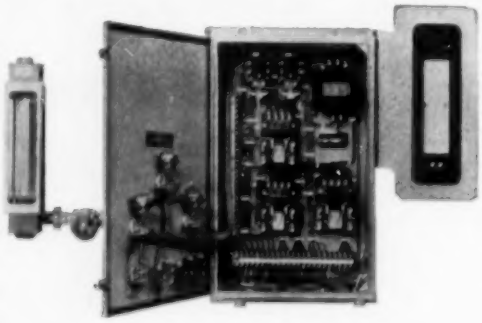

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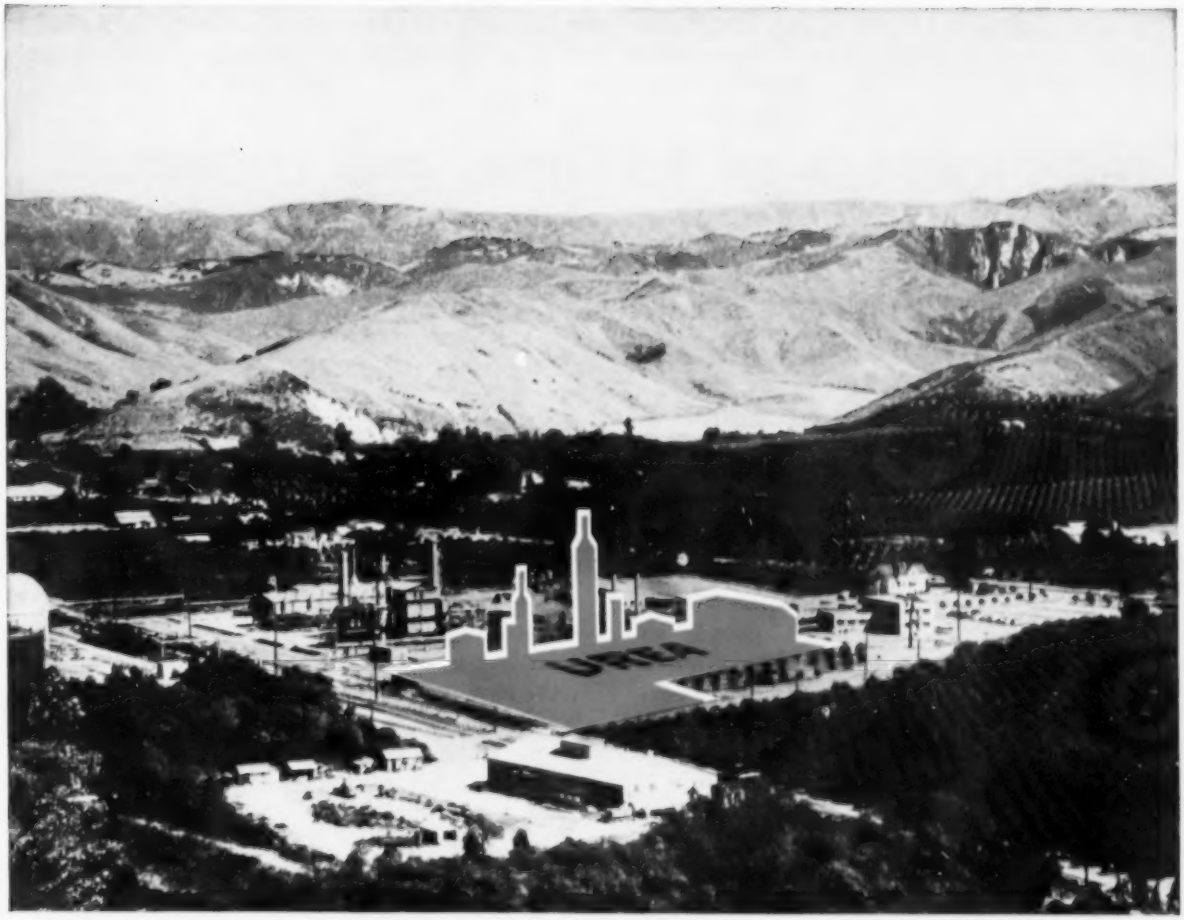

SHELL CHEMICAL IS ADDING SOMETHING NEW

Next door to its ammonia plant at Ventura, California—in the heart of a rich agricultural area, Shell Chemical Corporation has picked the logical location for its new urea plant. The M. W. Kellogg Company worked with Shell Chemical in engineering the project, and is now well ahead with construction. The plant will be completed this fall. M.W. Kellogg also engineered and built Shell Chemical's adjacent 150 ton/day ammonia plant, from which raw materials will be piped into the urea facilities.

Designed to produce 100 tons of high purity urea per day, the Ventura plant will be the chemical industry's first urea manufacturing facilities on the West Coast. It will also be the first urea plant in the entire United States to use a new process which, in addition to being considered the most efficient yet developed, overcomes the severe corrosion problems encountered with conventional urea processes.

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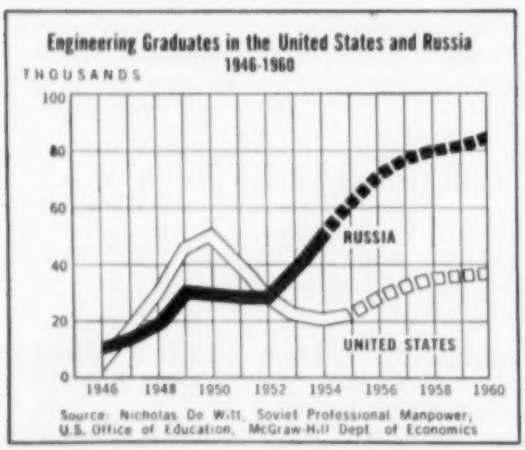
THE SHORTAGE OF SCIENTISTS AND ENGINEERS:

Are We Losing the Race with Russia?

THERE is new confidence in the Kremlin. One key reason is expressed in a recent boast of Communist Party Secretary Khrushchev: **"The capitalists always regard our people as being backward, but today we have more engineers and more supporting engineering technical personnel than any capitalist country."** He promised that this lead would be widened and that communism would be victorious without war.

This boast cannot be dismissed as communist propaganda. Admiral Lewis L. Strauss, chairman of the U. S. Atomic Energy Commission, has warned: **"In five years our lead in the training of scientists and engineers may be wiped out, and in ten years we could be hopelessly outstripped. Unless immediate steps are taken to correct it, a situation, already dangerous, within less than a decade could become disastrous."**



This second editorial in a series on the shortage of scientists and engineers is designed to explore as carefully as possible the facts and the implications of the new emphasis on technical training in the Soviet Union. It draws heavily from the authoritative book *Soviet Professional Manpower,* prepared for the National Academy of Sciences and the National Research Council by Nicholas DeWitt of the Russian Research Center of Harvard and released recently by the National Science Foundation.

Trend Is Against Us

If the Soviet Union already has a lead in technical manpower, it is not very great. Both the United States and Russia now have around a million scientists and engineers. About a third of the Russian engineers were trained on inferior pre-1935 standards. **It's the trend — shown in the chart — that is alarming.**

Over the last five years we have turned out only 142,000 engineers, compared to an estimated 216,000 in Russia. In 1955 our output was around 23,000 compared to their 63,000. Over the next five years our projected output is 153,000, against at least 400,000 in Russia. There will be an additional 150,000 or more in the satellites and Red China.

In Russia, 30% of the college students are in engineering, compared to 8% here. Another 30% or more take degrees in natural sciences. Moreover, unlike ourselves, the Russians are

ploughing back a large proportion of their science graduates into teaching, which implies a rapid buildup in the future.

Quality As Well As Quantity

It would be foolhardy to assume that these new Russian graduates are inferior to ours in the quality of their technical training. They start out with much more intensive mathematical and scientific preparation at the high school level. They study harder and longer in college, with more laboratory work and more practical training. Their courses and textbooks seem to be as thorough as ours. Even though the Russian graduates may be overspecialized, they get results.

These results have been striking. The Russians developed both A-bombs and H-bombs faster than we expected, and it's not certain that they had to rely much on espionage. They pushed ahead of us for a while in jet fighter design, and they showed up with a fleet of long-range bombers well ahead of schedule. They are crowding us on nuclear power, electronics and automation. There are grave fears that they have established a lead in the vital field of military rockets.

The goal of Soviet scientific manpower policy includes not only weapon supremacy but also leadership of the neutral and uncommitted areas of Asia, Africa and the Middle East. The Soviet leaders may be bluffing in their offers to export capital, but they are preparing to export Russian scientific and technical know-how in a big way.

How They Do It

The Russians are determined to win the race for scientific supremacy, and they do not count the cost. **They pay their scientists and engineers salaries that seem fantastic when compared with other Soviet incomes.**

Senior professors, research scientists and top engineers are a major segment of the Russian elite. Their incomes are frequently six to ten times the average industrial wage. (In the U. S. six to ten times the average industrial wage would be $25,000 to $40,000 a year.) Housing and other privileges are correspondingly lavish. While preaching equality, the Soviets use capitalistic incentives far more boldly than we do. Indeed, practicing engineers and scientists have been complaining about the exalted status of professors and top research people, and salary scales are now being adjusted to give greater emphasis to practical results.

The Russians are also generous in their aids to education. Tuition has just been made free at all levels. Undergraduates receive 200 to 500 rubles a month and graduate students 800 rubles (about equal to an industrial wage) to cover living expenses. The biggest stipends go to science and engineering students. College students are deferred from military service, and engineers and scientists often enjoy continued deferment even after graduation.

Finally, the Soviet leaders can channel engineers and scientists — and all other human and material resources — into any area they choose. And the areas the Soviet leaders choose are predominantly those that contribute to military or political objectives, rather than to a better life for consumers.

What's Our Answer?

We are certainly not going to adopt Soviet methods. We do not want scientific robots, but free men, able to understand and add to our democratic heritage. At the same time, our world leadership in technology — and perhaps even our survival as a nation — will be threatened if we allow ourselves to lag far behind Russia in the training of scientists and engineers. Ways to keep the United States in the race will be discussed in a later editorial in this series.

This is one of a series of editorials prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments of particular concern to the business and professional community served by our industrial and technical publications.

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Donald C. McGraw

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EDITORIALS . . .

The Public Is Not "Bedamned"

WHEN we were very young—oh, maybe 9 or 10 years old—it used to annoy us no end to have to help clean up the house "special" because "company was coming." To our youthful mind it seemed that "company" was just "other people," and they ought to be able to see us as we were all the time. Our parents had other ideas though: they felt we should be slicked up in our Sunday best.

Looking back at those days from the year 1956, there seems to be a grain of truth in both opinions—and perhaps a lesson for today's refinery operators.

Next October is Oil Progress Week—the time when our industry will tell the general public a little about ourselves, how we operate our plants, make gasoline and other products, how we get the crude oil, and how we move the products to the consumer. It's a time when we as an industry will be putting on our "Sunday best." (See pp. 93-95.)

Our point is this. We agree that putting on our Sunday best next October is a good thing. By all means, let's show the public all our wares when "company comes." This makes for good public relations, and we have no quarrel with it.

But even further, we think the industry should do all it can to **live** good public relations at all times. We should constantly build a good backyard behind a good front. When we are under criticism by the public for one reason or another, we should take a good long look at ourselves. If the criticism is unfounded, we should fight back for all we're worth, but diplomatically, and with finesse. However, if the criticism is backed up by facts, let's admit our faults.

If disaster strikes—a fire or an explosion—it is essential that we report promptly all the facts behind such a disaster, and what caused it. A good example was the prompt report by Standard Oil Co. (Indiana) last year on its explosion and fire at Whiting.

If we are accused of creating a public nuisance, we must seek out the truth and set it before the public. Again, a good example is the work being done by the petroleum industry on the West Coast on the smog situation. This is especially meritorious in view of the viciousness of attacks by minority groups that claim to be acting in the name of the general public.

If we are accused of unethical practices and of being political, we should seek out the true malefactors in our industry. We should patiently explain to the public that one bad apple does not ruin the barrel. This is happening right now with the bad publicity surrounding the natural gas bill. It's admittedly a slow, laborious fight to regain prestige, but it can't help being won.

Public opinion is a strong force—and a vital one in the American economy. Our industry depends on good public opinion for continued business success, Let's do a good job the year round and keep it that way.

What Makes a Meeting Good?

THE 21st mid-year meeting of the API's Division of Refining in Montreal this past May was a good one It is generally acknowledged that it was one of the most successful gatherings the Division has had.

Attendance was 1580—the second largest since separate mid-year meetings of the Division were begun in 1947. This large attendance was particularly gratifying because the meeting was the first ever held by any division of API outside the United States. It gives positive evidence of the close community of interest existing between U. S. and Canadian refiners.

But mere numbers don't make a good meeting. You have to have a program that interests the people attending, which attracts them, and which gives them value as promised. The Montreal meeting had all of that. Every one of the 12 technical sessions was well attended—and some of them to the point of "Standing Room Only." Comments overheard after the sessions attested to their value.

We were particularly impressed with the Dinner Session—and the speaker of the evening. The Hon. L. B. Pearson, Canada's Secretary of State for External Affairs, spoke on a most serious topic—petroleum's impact on Canada's economy and on world politics. And he proved that after-dinner speakers at API meetings don't have to confine themselves to light, humorous themes to be successful.

There was one thing about the Montreal meeting, however, that struck us as most significant. For the first time, to the best of our knowledge, the refiners in an area where a Refining Division meeting was to be held got together and organized a local committee to help promote the meeting.

To our way of thinking, it was the work of this local Montreal committee that was to a very large extent responsible for the spirit of enthusiasm and the feeling of being welcome that was so much in evidence throughout the meeting.

We don't mean to minimize the splendid work done by the API staff and the Division's Program Committee. But we sincerely recommend that the API Refining Division make it a standard practice to encourage the formation and work of an active local committee for each of its annual mid-year meetings.

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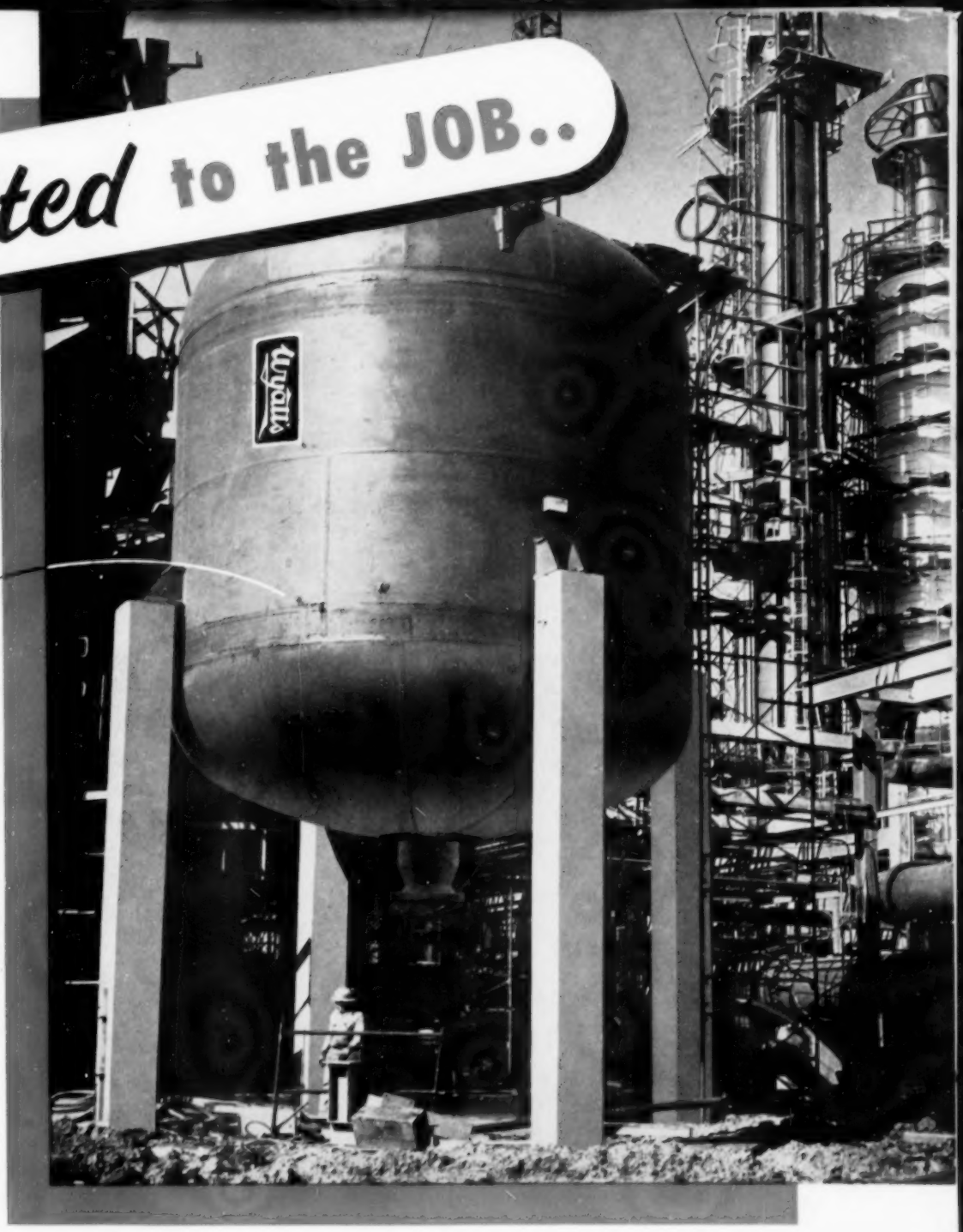

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